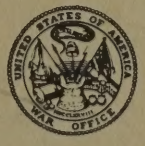
FM 6-162

DEPARTMENT OF THE ARMY FIELD MANUAL

RADAR SET AN/TPS-25



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RADAR SET AN/TPS–25

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*This manual supersedes FM 6–162, 2 April 1962, and Chapter 9, FM 6–125, 23 April 1963.

CHAPTER 1

GENERAL

1. Purpose

This manual is a guide for personnel responsible for employing and operating the radar set AN/TPS–25 or AN/TPS–25A. This manual will refer only to the AN/TPS–25, but all information applies to the AN/TPS–25A as well.

2. Scope

a. This manual covers the equipment and operating procedures to be used by sections employing radar set AN/TPS–25 in accomplishing the battlefield surveillance and moving target location missions, operations in an electronic countermeasures environment, decontamination and destruction of equipment, safety precautions, and section training.

b. The material presented herein is applicable, without modification, to both nuclear and nonnuclear warfare.

c. Related publications are listed in the appendix.

3. Changes

Users of this manual are encouraged to submit recommended changes or comments to improve the manual. Comments should be keyed to the specific page, paragraph, and line of text in which change is recommended. Reasons should be provided for each comment to insure understanding and complete evaluation. Comment should be forwarded direct to Commandant, U.S. Army Combat Surveillance and Electronic Warfare School/Training Center, ATTN: AMCTC–CSS/NE–T, Fort Huachuca, Arizona 85613.

CHAPTER 2

EQUIPMENT

4. Description

a. The AN/TPS–25 (fig. 1) is a transportable, battlefield surveillance radar set of the noncoherent Doppler type and is designed to detect and locate moving ground targets at ranges between 450 and 18,280 meters. In normal operation, the radar set is capable of locating a moving man at a range of approximately 4,500 meters and a moving vehicle at a range of 18,280 meters—the maximum range of the set. This radar can be used to supplement surveillance of the battlefield by forward observers.

b. There are two means of target presentation on the AN/TPA–25—a visual presentation on a cathode-ray tube and an audible presentation on a loudspeaker and earphones.

c. Target locations are represented on the range, azimuth, and elevation counters and on Cartesian (X and Y) coordinate counters. The location of a target also may be indicated by the indicator light, (called the BUG LIGHT), shining through tactical display plotting board, or overlay/battle map placed over the plotting board. This presentation is especially useful in tracing a moving target, since it enables the operator to *predict* a point upon which fire can be delivered.

5. Components

a. The components of the radar set AN/TPS–25 are discussed in detail in TM 11–5840–217–10, TM 5–6115–271–15, and TM 5–2805–203–14, to include the nomenclature, technical characteristics, and operation of the equipment. The major components of the radar listed below are transported in a 1½-ton cargo trailer and a 2½-ton cargo truck is used as a prime mover.

*(1) Radar set control

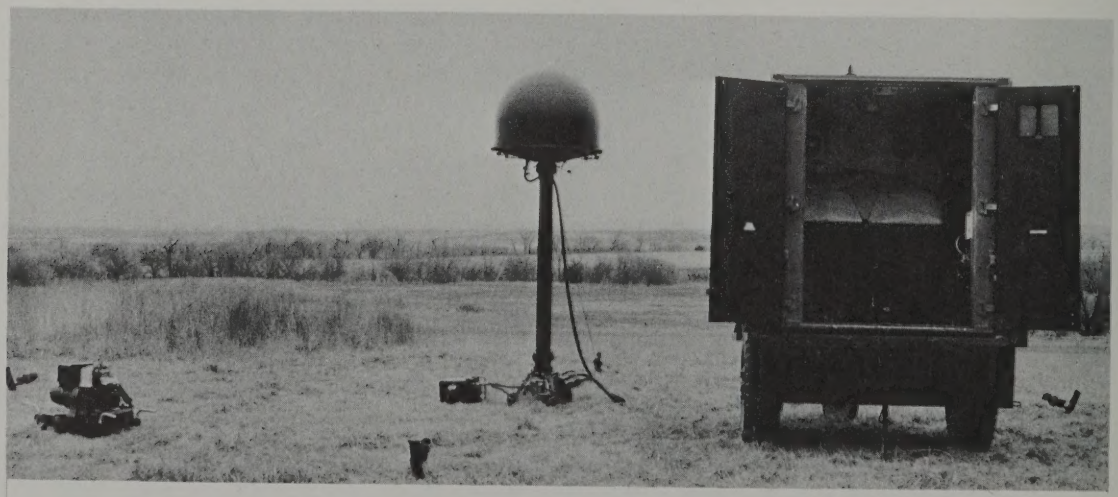


Figure 1. Radar Set AN/TPS–25.

*(2) Power supply
*(3) Plotting board
*(4) Tactical display board
(5) Antenna
(6) Receiver-transmitter
(7) Modulator
(8) Generator set

*Normally operated from the electrical equipment shelter S–124/G. The remaining components are removed from the shelter during operation.

b. All components of the radar set including the generator set are secured within the shelter during travel to prevent damage. Components which are operated outside the shelter are equipped with quick-release latches, for their rapid removal.

6. Performance Data

Pertinent performance data for the radar set are as follows:

a. Azimuth Limits—6,750 mils.

b. Beam Width.

(1) Search—10° (180 mils)
(2) Track—2° (36 mils)

c. Sector Coverage—360 mils or 540 mils.

d. Elevation Coverage—−265 to +265 mils.

e. Range, Maximum.

(1) Moving vehicles—18,280 meters.
(2) Moving man—12,000 meters.

f. Range Detecting Minimum—450 meters.

g. Automatic Range Search Coverage—Strobes 900 meter segment of an azimuth sector of 180 mils selected by the operator.

h. Accuracy—0–100 meters.

i. Weight—2,960 pounds including shelter.

j. Normal Means of Transport—1½-ton, two-wheel trailer.

7. Technical Characteristics

The technical characteristics of the radar are as follows:

a. Frequency—9,375 megahertz (X-band).

b. Pulse Repetition Frequency—1,850 pulses per second.

c. Pulse Width—0.5 microseconds.

d. Peak Power Output—43 kilowatts.

e. Intermediate Frequency—60 megacycles.

f. Power Requirement—115-volt, 400-hertz, single phase, alternating current at 1.5 kilowatts.

CHAPTER 3

PREPARATION FOR ACTION

Section I. EMPLACEMENT AND MARCH ORDER

8. General

a. All components of the radar set AN/TPS–25 are stored in the equipment shelter S–124/G (fig. 2) which is mounted on the 1½-ton trailer. The trailer is towed by a 2½-ton truck.

b. The radar site consists of the following installations:

(1) Radar operations center.
(2) Antenna with receiver-transmitter.
(3) Power unit.

c. The components of the radar set are heavy and awkward to handle. Caution should be ex-

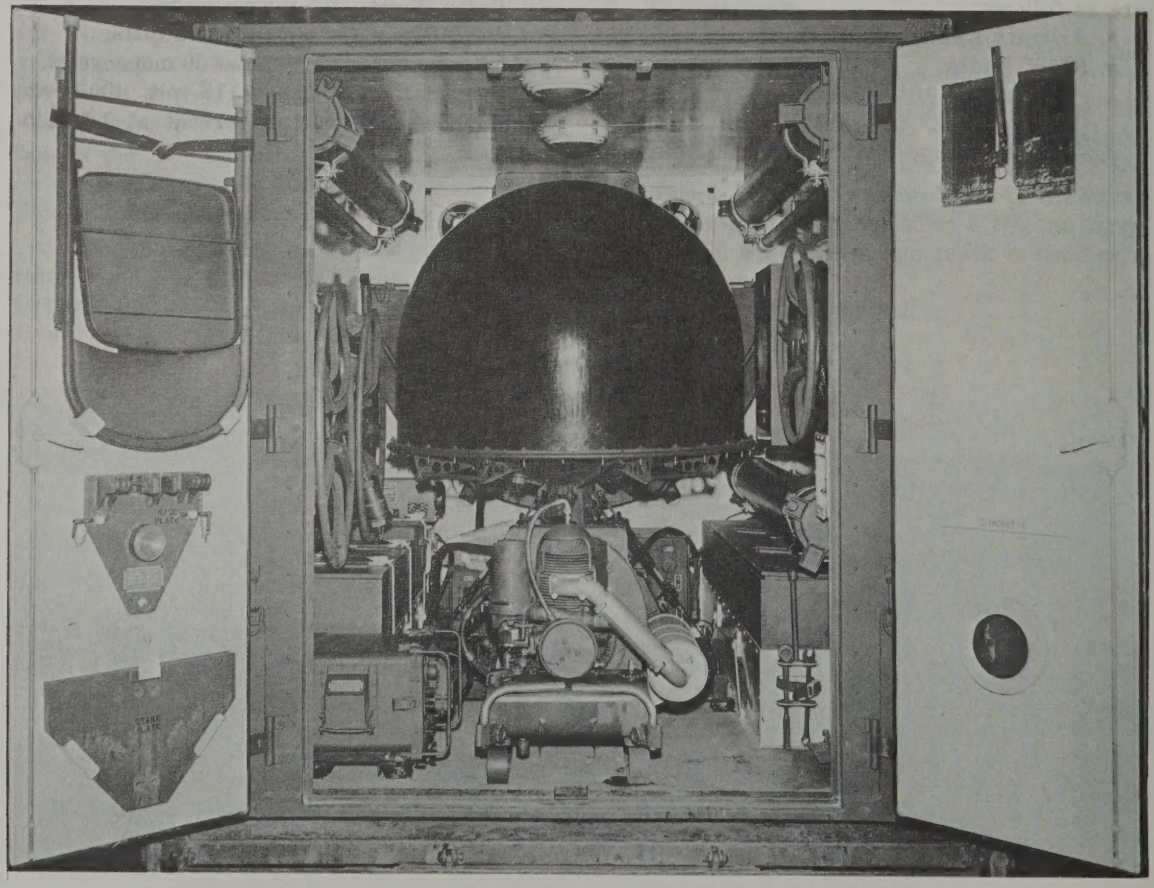


Figure 2. Interior of shelter with components stored.

ercised when removing from, or replacing the components in the equipment shelter to prevent injury to personnel and damage to the radar components.

9. Emplacement

a. Emplacement of the Trailer.

(1) Lower the stability jack at the rear of the trailer.

(2) Uncouple the trailer from its prime mover and orient the trailer as directed by the section chief.

(3) Set the trailer handbrake and chock the trailer wheels.

(4) Open the two shelter doors and remove the center post from the shelter doorway.

b. Removal of Components.

(1) Loosen and remove clamps holding the generator set and carry it to the operating site. (This step is required when power unit PU 450/G is used.)

(2) Remove the modulator from its mount and carry it to the antenna site.

(3) Remove the antenna receiver-transmitter from the shelter and carry it to the antenna site. Loosen and remove the four turnbuckle clamps and lift the antenna receiver-transmitter assembly from the shock mount. Leave the shock mount at the antenna site.

Note. If the antenna is to be placed on one or more mast sections, disconnect the antenna from the receiver-transmitter and place it on its side with the support leg down.

(4) Remove the required number of mast sections and the two sections of the boom. If the antenna is to be mounted on one mast section, the boom is not used.

Note. If the mast is not used, remove the lower mast section to facilitate entry into the accessory box.

(5) Remove the three cable reels from the walls of the shelter and position the cables as required for the installation.

(6) Remove from the accessory box the equipment needed to emplace the antenna.

(7) If the base plate and the sand plates are to be used, remove them from the left door of the shelter and take them to the antenna site.

(8) Using two men, place the plotting board and the radar set control unit in the operating position.

c. Installation of the Antenna. The antenna can be emplaced directly on the receiver-transmitter or can be mounted on one, two, or three mast sections. The procedure for installing the antenna on mast sections is essentially the same regardless of the number of mast sections used.

(1) *Placement of the base plate and the guy-wire stakes.*

(*a*) Orient the base plate so that the socket is directly over the antenna site stake and the small end of the base plate points toward the area of interest.

(*b*) Drive two round-headed stakes into the ground through the two holes in the sides of the base plate.

***Caution:* Do not strike the base plate with the sledge hammer.**

(*c*) Place the center link of the A measuring rope over the socket of the base plate and stretch the 20-foot section of the rope toward the area of interest.

(*d*) Drive a guy-wire stake into the ground at the point marked by the link at the end of the A rope.

(*e*) Along this same line add a second stake 2.5 feet from the first.

(*f*) Connect the two front guy-wire stakes together with the short length of chain and the chain support.

Note. Each stake should be at a 60° angle to the ground and point away from the base plate and each stake should be driven into the ground until the middle hole is just above ground level. If the soil is sandy, fasten the sand plates to the guy-wire stakes.

(*g*) Stretch the 26-foot section of the A rope away from the area of interest and in a straight line with the 20-foot section and the front guy-wire stake.

(*h*) Drive a round-headed stake into the ground through the ring at the end of the 26-foot section of the A rope.

(*i*) Pass one end of the B rope (32 feet 10 inches) over the round-headed stake and stretch the B rope to the left of the base plate.

(*j*) Keep the center link of the A rope over the base plate socket and stretch the 20-foot section of the rope to the left of the base plate.

(*k*) Overlap the free ends of the A and

B ropes, stretch them tightly, and drive a guy-wire stake into the ground at the point marked by the overlapping ends.

Note. This procedure insures that each side stake is placed at a right angle to the front and rear stakes.

(*l*) Holding the overlapping ends of the two ropes, move to the right side of the base plate, pull the ropes tight, and drive the fourth guy-wire stake in the ground at the point marked by the overlapping ends.

(*m*) Pull up the round-headed stake that holds the two ropes and drive it through the third hole in the base plate.

(*n*) Drive the fifth guy-wire stake in the hole where the round-headed stake was removed. Place the A and B ropes in the accessory box.

(2) Connection of antenna components.

(*a*) Place the receiver-transmitter unit on the base plate and insert the hinge pins through the meshing hinge blocks on the unit and the base plate.

(*b*) Insure that the four jack pads are retracted fully to avoid any damage.

(*c*) Tilt the receiver-transmitter so that the rear carrying handles rest on the ground.

(*d*) Remove the cover from one mast section and connect the mast to the socket at the top of the receiver-transmitter.

Note. When a protective cover is removed or replaced, the waveguide should be checked for dirt or foreign matter.

(*e*) Connect the second mast section to the first after removing the covers.

(*f*) Insure that the antenna support leg is in the out position and that the antenna rests on the leg during the assembly procedure. This protects the radome from damage and insures that the antenna stops will face away from the area of interest.

(*g*) Connect the antenna to the mast sections.

(*h*) Connect the 25-foot cable (W2801) to the jack on the underside of the antenna. Secure the cable to the mast with the cable clamps on each mast section.

Note. Do not fasten the cable to the receiver-transmitter until the antenna has been erected.

(*i*) Open the two breather ports on the underside of the antenna.

(3) *Installation of guy wires, guy ropes and boom.*

(*a*) Using the ends with the shackles, fasten three guy wires to the eyelets on the antenna mast coupling.

(*b*) Fasten the match hook of the front guy wire to the antenna eyelet.

Note. TM 11–5840–217–10 states that the match hook (split link) should be used at the antenna; however the match hook has a tendency to uncouple unless it is under tension. Using a match hook at the end toward the winch permits it to be observed more closely and places it within reach if it needs recoupling. It is recommended that the shackles from the lifting harness be used to replace the match hooks.

(*c*) Attach one of the winch hoists to the lower hole of each guy-wire stake, and pull the winch cable out until it can be fastened to the match hook of the guy wire. Insure that the guy wires are not twisted or crossed.

(*d*) If three mast sections are used, hook the winch cables to the end of the guy-wire link; if two mast sectioss are used the winch cables are hooked to the guy wire link 6⅓ inches from the end. When only one mast section is used, the guy wire links need not be used. To replace the match hooks, hook the winch cables directly to the antenna eyelets.

(*e*) The boom must be used if two or three mast sections are utilized. Use Dacron guy ropes to steady the boom during erection.

(*f*) Attach the snap hooks at the ends of the guy ropes to shackle which fastens the front winch cable to the guy wire.

(*g*) Assemble the two sections of the boom and place the pin at the end through the shackle where the guy ropes were fastened.

(*h*) Raise the boom and place the lower end in the socket on the receiver-transmitter.

(*i*) Fasten the guy ropes to the side stakes with the guy rope lock and adjust the guy ropes so that the boom is vertical and the ropes are taut.

(*j*) The boom and guy wires are not used with one mast section.

(*k*) When all components are in place the layout should appear as shown in figure 3.

(4) *Erection of the antenna.*

(*a*) Insure that the front and side winch cables and guy wires are taut.

(*b*) At the rear winch, wind in the cable on the winch drum.

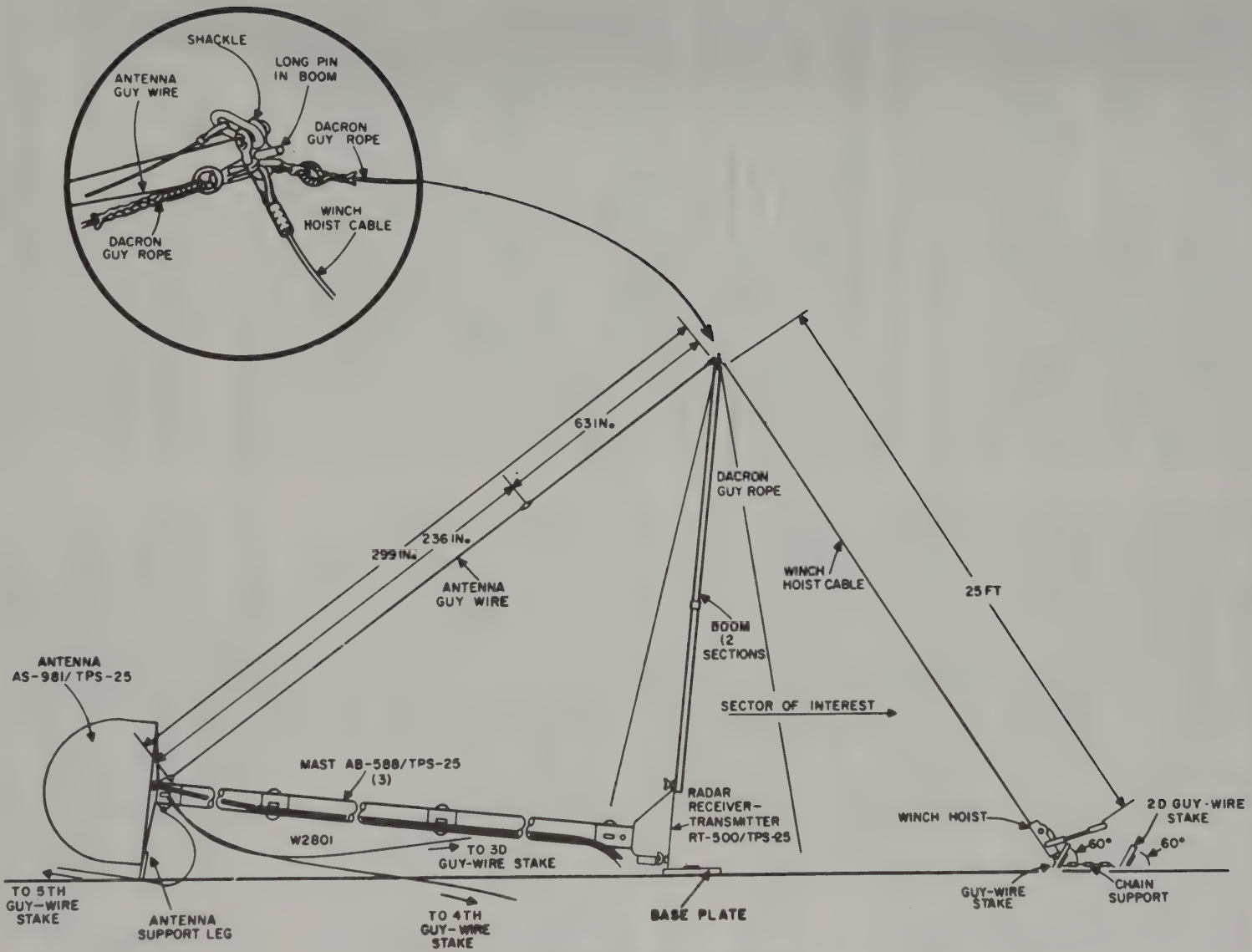


Figure 3. Layout of antenna for erection.

(*c*) Using the winch at the front stake, slowly and carefully raise the antenna. The movement of the winch will cause the antenna to bounce and will increase the danger of uncoupling the match hook on the guy wire. Therefore, one man should hold the cable to dampen the oscillations.

(*d*) Continually check the boom to see that it remains in line with the mast. If the boom leans to one side, use the guy ropes to return it to the vertical position.

Caution: **Insure that the antenna does not sway or twist during its erection. The hinge pins and meshing hinge blocks on the receiver-transmitter and the base plate are sheared off easily.**

Warning: **If the antenna is mounted on two or three mast sections, insure that no personnel are beneath the antenna while it is being raised or lowered.**

(*e*) Use the side winches to keep the mast and the antenna rising in a vertical plane without leaning to one side.

(*f*) Keep the guy wires taut at all times.

(*g*) As the antenna is raised, the rear guy wire will become tight. The rear winch must be let out as slowly as the front is taken in to insure that the antenna does not tip forward after it reaches the vertical position.

(*h*) When the antenna approaches the vertical position, remove the boom from the shackle and the receiver-transmitter, and take up any slack in the guy wires. Remove the guy ropes.

(*i*) Connect the lower end of the antenna cable to the receiver-transmitter.

d. Cabling the Radar Components.

(1) Drive a ground stake into the ground next to the generator and connect it to the grounding terminal on the generator.

(2) Drive a ground stake into the ground next to the junction box on the shelter and connect it to the grounding post in the shelter port.

(3) Connect the modulator to the receiver-transmitter with the 2-foot cable (W2803) and the 5-foot cable (W2802).

(4) Connect the receiver-transmitter to the shelter cable port, using the 25-foot cable (W2804) and one or two of the 100-foot cables (W2805 and W2806) as required.

(5) Connect the shelter cable port to the pigtail W2814 with the 100-foot power cable (W2813).

(6) Inside the shelter, connect the plug of the cable (W2601) from the power distribution box to the coordinator.

(7) Turn on the power supply switch if the radar set is operated from the shelter.

(8) Check to insure that all cable connections are tight.

10. March Orders

a. Turn off the power switch on the power supply.

b. Stop the generator and disconnect pigtail cable W2814 from the generator.

c. Disconnect all cables from the receiver-transmitter.

d. Close and fasten the covers on the air intake and exhaust ports on all components.

e. Remove the boom sections and the two Dacron guy ropes from the shelter.

f. Attach the snap hooks of both Dacron guy ropes to the shackle on the end of the front guy wire. Leave the opposite ends of the guy ropes free.

g. While one man at the front guy-wire stake loosens the front guy wire, a man at the rear stake takes up the slack in the rear guy wire, both keeping the guy wires taut to prevent the antenna from swaying.

h. Continue lowering the antenna until the long pin on the end of the boom can be inserted through the shackle on the end of the front guy wire while the opposite end of the boom is inserted into the boom-socket of the receiver-transmitter.

i. Hook the Dacron guy-rope locks through the top holes in the side guy wire stakes and draw the ropes taut.

Note. One man should hold the front guy wire cable to dampen oscillations.

j. Lower the antenna to the ground.

k. Disconnect the antenna cable and replace the protective cover caps.

l. Wind the cable on the reel.

m. Remove and disassemble the boom and place the boom section in the shelter.

n. Unhook the Dacron guy ropes and place them aside.

o. Disconnect the four guy wires and coil them and tie them together. Operate the winch hoists and fully retract their cables. Unhook the four winch hoists, remove the handles, and place the guy wires, winch hoists, and handles aside.

p. Separate the antenna from the mast and replace the protective covers on the exposed waveguide coupling of the mast.

q. Disconnect the receiver-transmitter from the mast and immediately fasten the dust cover securely over the exposed waveguide of the mast.

r. Tip the receiver-transmitter upright and remove the hinge pins that secure the receiver-transmitter to the base plate.

s. Lift the antenna onto the receiver-transmitter and mate the two mast couplings. Make sure that the antenna support leg is secured under the antenna and is toward the back of the receiver-transmitter.

t. Place and secure the antenna and receiver-transmitter on the shock mount.

u. Disconnect the mast sections and immediately fasten the protective covers securely over the exposed waveguides.

v. Remove the three base plate stakes, slip the base plate ove rthe dowels on the inside of the door of the shelter, and secure it in place. Palce the base plate stakes aside.

w. Remove the four guy-wire stakes from the ground. If the stake plates have been fastened to the stakes, remove them and replace the bolts in the stakes. Mount the stake plates in their bracket on thee inside of the shelter door; place the guy-wire stakes aside.

11. Repacking the Shelter Operating Components

a. Disconnect W2601, W2607 and W2608 from the coordinator.

b. Secure the plotting board, with the radar set control unit attached, to the front interior wall of the shelter.

c. Place the components in the accessories box i n the following sequence: Guy-wire stakes, base plate stakes, ground stakes, winch hoists, measuring ropes, Dacron guy ropes, winch hoist handles, antenna guy-wire assemblies, and two sledge hammers. Secure the straps around each of the articles stored in the compartments.

d. Place the two cables (modulator to receiver-transmitter) in the storage box.

e. Place and secure the mast sections in the shelter.

f. Place and secure the cable reels in the clamps provided on the walls of the shelter.

g. Place and secure the modulato rin the shelter.

h. Lift the assembled antenna, the receiver-transmitter and the shock mount into the shelter. Secure the shock mount to the floor.

i. Place and secure the generator set in the shelter. Place the spare generator in the prime mover.

j. Place the ratchet wrench with the socket attached, the open end wrench, and the extension bar in the wrench bracket.

k. Replace the center post in the doorway of the shelter.

l. Inspect and secure the shelter for travel. Raise the stability jack at the rear of the trailer, hook the trailer to the prime mover, remove the chock blocks and release the handbrakes.

Section II. START-STOP PROCEDURES

12. General

The procedures outlined in this section are necessary for efficient operation of the radar set AN/TPS–25. They should be performed in sequence when possible.

13. Preoperation Checks

a. Cables. Check all cables, including the ground cable, to insure that they are connected properly.

b. Vents. Open all vents—on the coordinator and on the modulator, on the receiver-transmitter, on the antenna, on the power supply, and on the radar set control. If the fans in the shelter are to be used, open the four shelter vents.

c. Power Unit. Make the following checks:

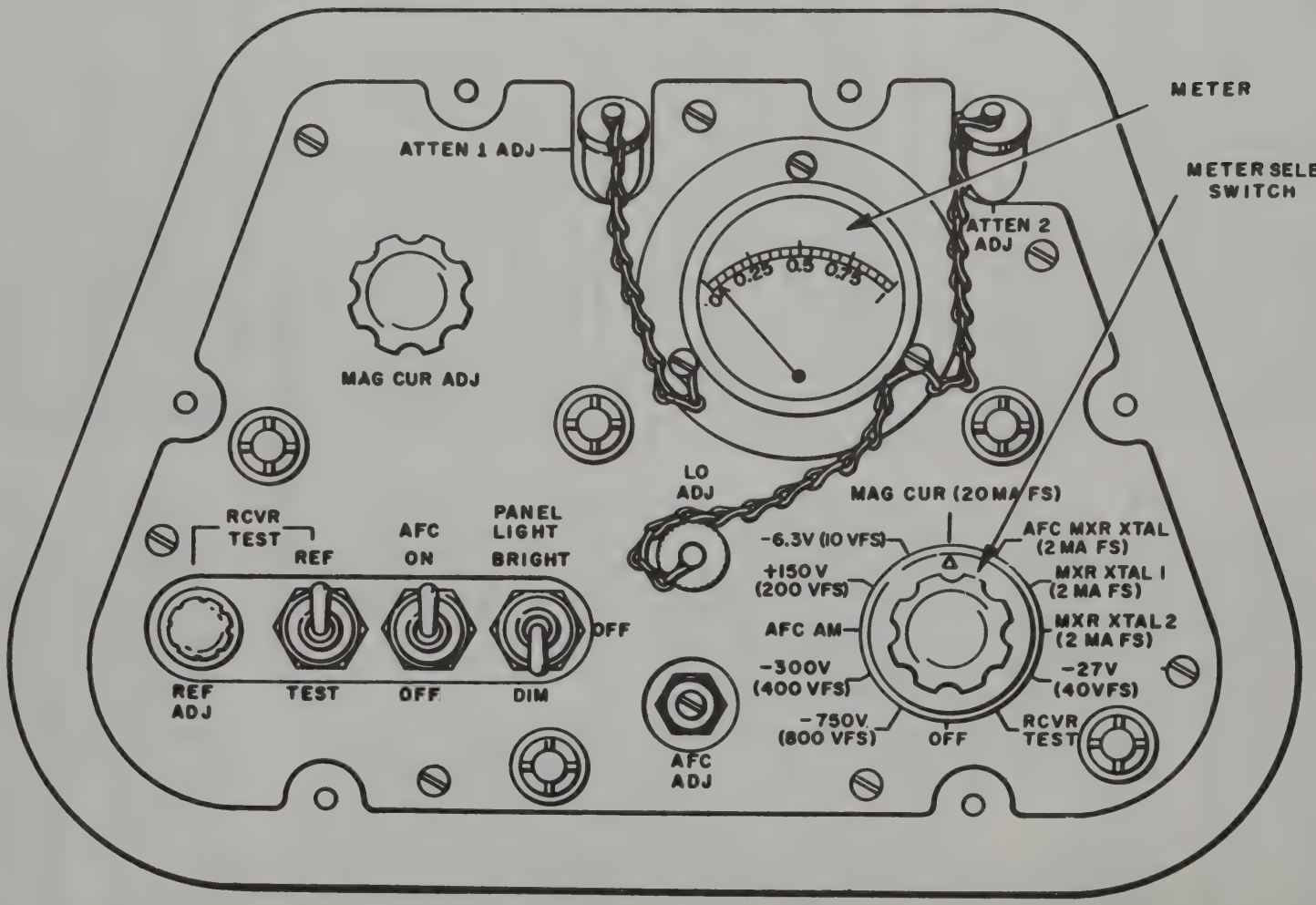


Figure 4. Receiver transmitter meter panel.

(1) Determine that the cable and/or switches are connected, or set, to provide SINGLE PHASES 400 HERTZ power input to the radar.

(2) Turn the power switch to the OFF position.

d. Receiver-Transmitter. If the radar set is installed under blackout conditions, turn the PANEL LIGHT switch on the receiver-transmitter panel (fig. 4) to the OFF position and insure that the leveling lights are off (TPS–25A only). Close panels on the TPS–25 by turning lens fully counter clockwise.

e. Shelter Junction Box. Turn all switches and circuit breakers off (fig. 5.

f. Control Unit. If the control unit is to be operated inside the shelter, turn power switch on the power supply on. (If the control unit is to be operated outside the shelter, turn the power switch off.)

14. Starting Procedure

a. Start the generator set and make preliminary adjustments as prescribed in the appropriate TM for the generator used, e.g., voltage and frequency.

b. Turn the MAIN circuit breaker in the shelter to the ON position. If the fans, lights, or heater are to be used, turn the SHELTER circuit breaker and the required switches to

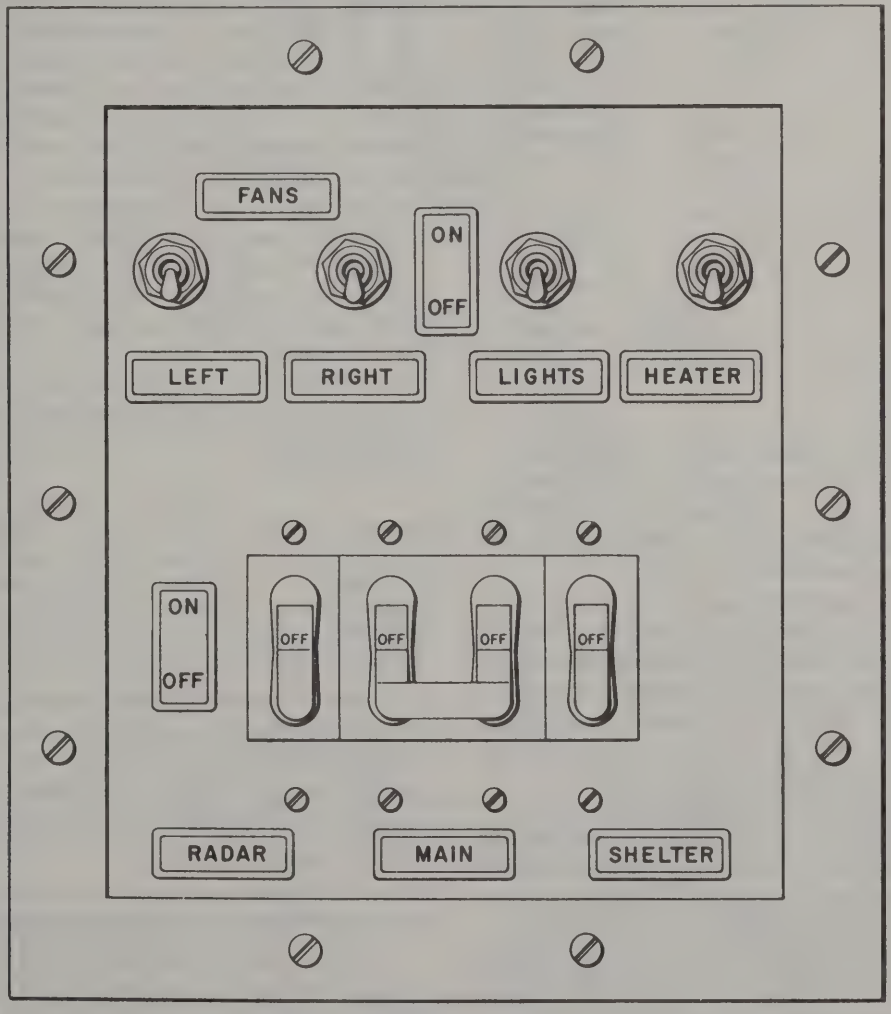


Figure 5. Shelter power distribution box.

their ON positions. Turn the RADAR circuit breaker to the ON position. (If the control unit is operated outside the shelter, turn the POWER switch of the power supply to the ON position (fig. 5).

c. On the power supply unit, turn the power switch on and regulate the power unit voltage until the needle of the voltmeter on the coordinator is at 115 volts.

15. Operational Checks

a. Check the following meter readings at the receiver-transmitter, and then return the METER SELECTOR switch to the MAG CUR position, see figure 4.

Position	*Full-scale reading*	*Correct meter indication*
−750V	800V	0.79 to 1.0
−300V	400V	0.63 to 0.86
AFC AM		0.35 to 0.85 (fluctuating)
+150V	200V	0.62 to 0.86
−6.3V	10V	0.53 to 0.73
MAG CUR	20 ma	0
AFC MXR XTAL	2 ma	0 to 0.75 (fluctuating)
MXR XTAL 1	2 ma	0 to 0.75 (fluctuating)
MXR XTAL 2	2 ma	0 to 0.75 (fluctuating)
−27V	40V	0.57 to 0.78
RCVR TEST		Not used by operator.

b. Rotate the ELEVATION handwheel to the upper and lower limits (+265 mils to −265 mils). The ELEVATION WARNING lamps should light prior to reaching maximum and minimum elevations (fig. 7).

c. With the plotting board arm at the center of the plotting board, declutch the plotting board arm and rotate the azimuth handwheel to both limits. Note the azimuth reading at these limits. The limits should be approximately 6,750 mils apart, and the AZIMUTH WARNING light should light when the antenna reaches each limit (fig. 6, 7).

d. Position the AZIMUTH handwheel so that the aximuth reading is approximately halfway between the AZIMUTH limits, and engage the plotting board arm. Rotate the azimuth handwheel first in one direction, then in the other. The plotting board arm should follow these movements. Rotate the range handwheel to increase the range, then to decrease the range. The range counter and the indicator light on the plotting board arm should follow these movements (fig. 6).

e. Level the antenna as follows:

(1) Energize the automatic leveling light circuit. (The circuit is found only on the "A" models. A switch is provided for this purpose and is located on the receiver-transmitter assembly. The circuit must be re-energized after 5 minutes if leveling is not completed. (See fig. 11, TM 11–5840–217–10.)

(2) Open the hood over each leveling light.

(3) The antenna is not level if any of the leveling lights are illuminated. The side with the illuminated lights is higher than the opposite side. Leveling is accomplished by tightening the guy wire over the lighted lamp and loosening the opposite guy wire. This technique is continued until all lights are extinguished. Before leaving the antenna, insure that each of the guy wires is taut.

f. At the radar set control panel, turn the RADIATE switch on. (The transmitter will not come on until 3 to 5 minutes after power is applied.) The RADIATE indicator lamp should light, and the baseline should appear on the A-scope.

g. Recheck the following positions of the meter on the receiver-transmitter; then return the METER SELECTOR switch on the MAG CUR position.

Position	*Full-scale reading*	*Correct meter indication*
MAG CUR	20 ma	0.7 (must be adjusted)
AFC MXR XTAL	2 ma	0.34 to 0.41
MXR XTAL 1	2 ma	0.34 to 0.41
MXR XTAL 2	2 ma	0.34 to 0.41

h. On the radar set control panel (fig. 7):

(1) With the VOLUME control and the SPEAKER VOLUME control (if the loudspeaker is used) set at their midpoints, adjust the RCVR GAIN control until the background noise is clearly audible.

Note. There must not be a target in the range gate when the RCVR GAIN control is adjusted.

(2) Set the VOLUME, SPEAKER VOLUME (on the loudspeaker), INTENSITY, FOCUS, VERTICAL, AND SCOPE GAIN con-

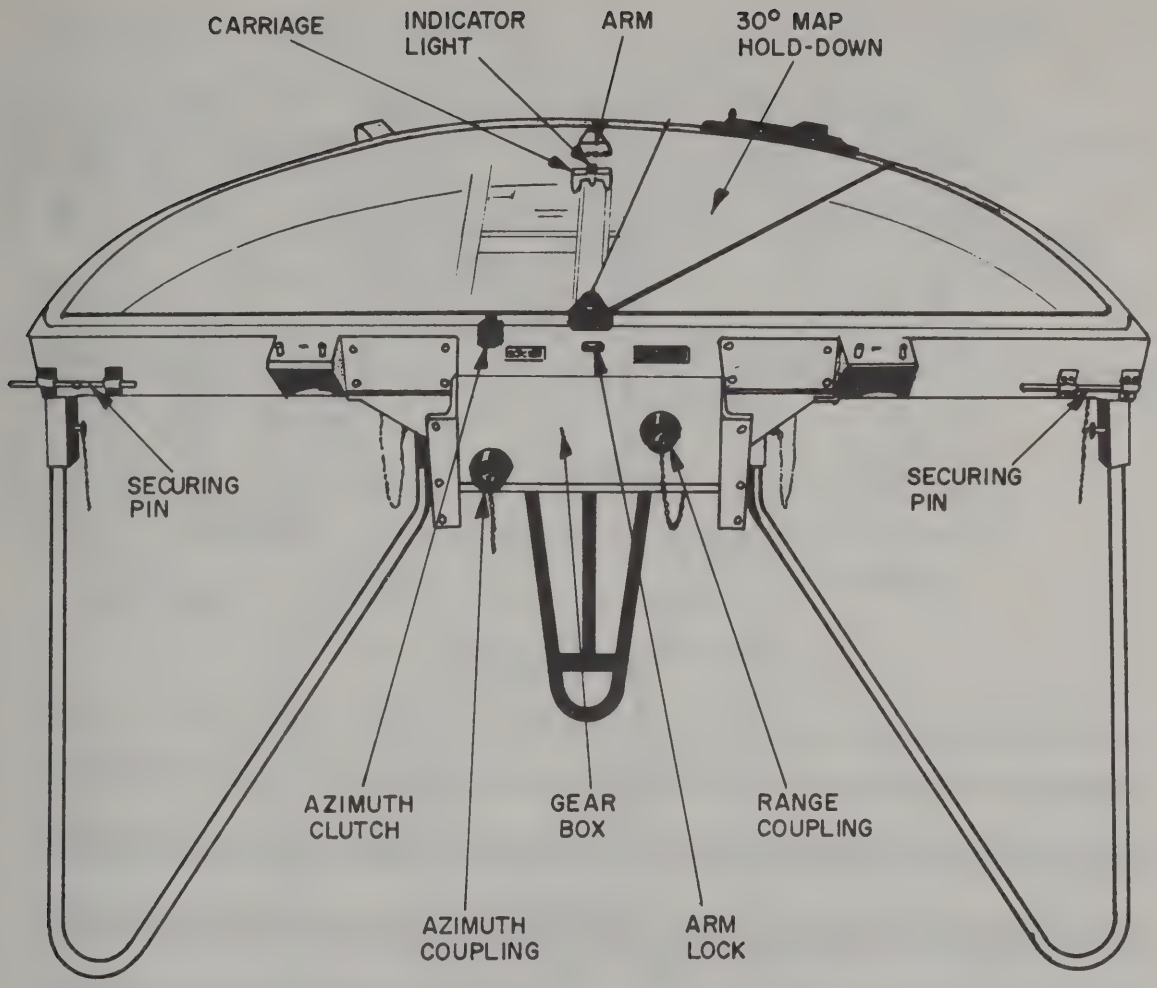


Figure 6. Tactical display plotting board.

trols to meet the requirements of the individual operator.

(3) Check each position of the AUTO-MAN selector switch for correct operation as follows:

(*a*) *AUTO SEARCH POSITION*—Antenna scans either a 360-mil or a 540-mil sector, automatic range search, and an A-scope presentation.

Note. Insure that the scribed lines on the SECTOR CENTER knob are alined before the antenna is placed in AUTO SEARCH.

(*b*) *AUTO RANGE POSITION*—Automatic range search, manual control of azimuth and A-scope presentation (fig. 8).

(*c*) *MAN SEARCH POSITION*—Manual control of azimuth and range and A-scope presentation (fig. 8).

Note. When the AUTO-MAN selection switch is changed from position 3 to 4 (or 4 to 3), the antenna should switch feedhorns. This will be indicated by a momentary disappearance of the sound and the scope presentation.

(*d*) *MAN TRACK AUDIO POSITION*—Manual control of azimuth and range and an audio display (presentation) on the scope (fig. 9).

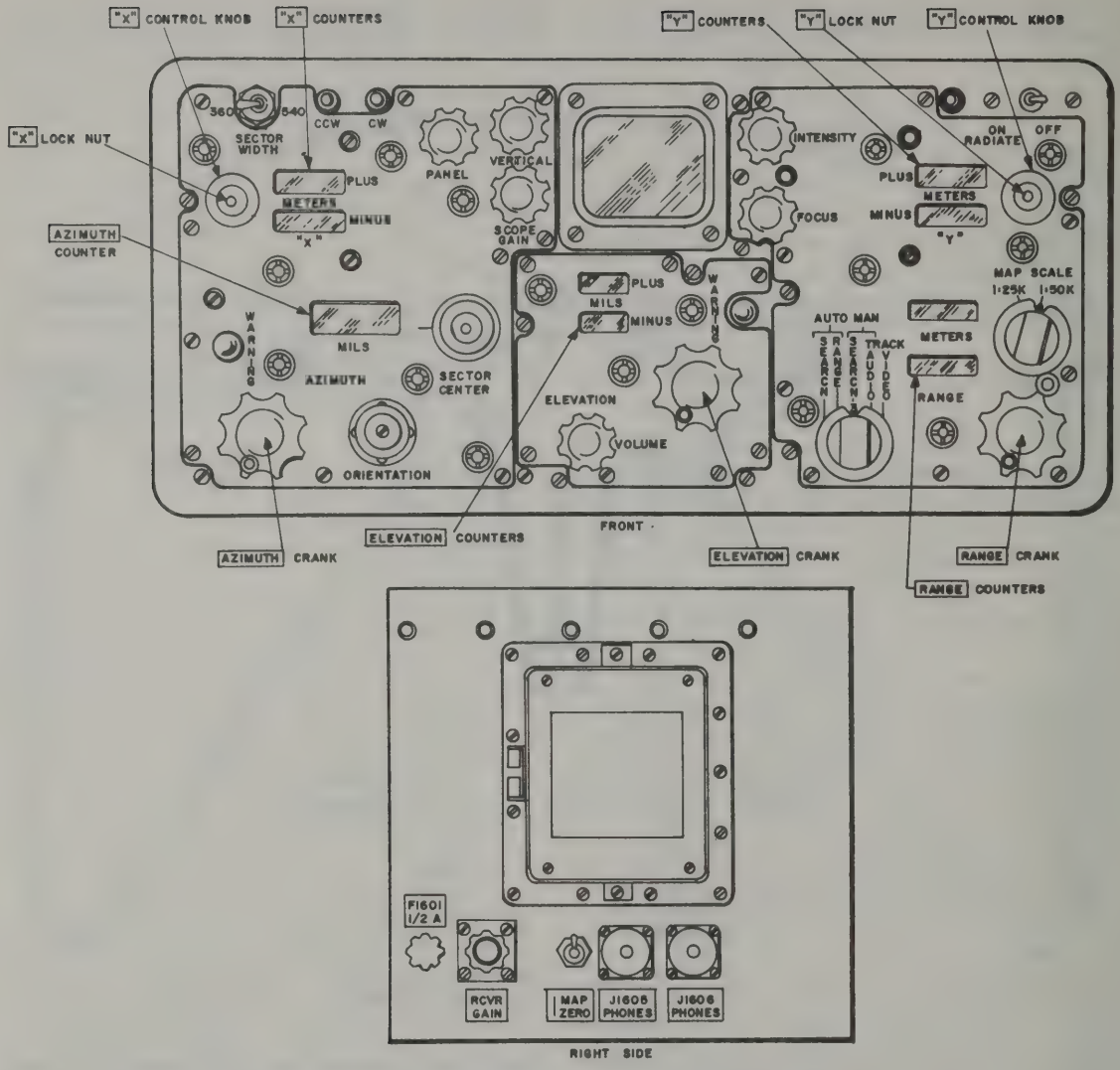


Figure 7. Radar set control, front panel and right side.

(*e*) *MAN TRACK VIDEO POSITION* —Manual control of azimuth and range and an A-scope presentation.

i. Rotate the ELEVATION handwheel to its upper and lower limits (approximately +265 mils to −265 mils.) The target should appear and disappear on the A-scope as the elevation is changed.

j. The set is now ready to be oriented and operated.

16. Normal Stopping Procedure

a. Turn the RADIATE switch to OFF.

b. Set the AUTO-MAN switch at position 3 (MAM SEARCH).

c. Turn the MAIN circuit breaker in the shelter to the OFF position.

d. Turn the power switch on the power supply to the OFF position.

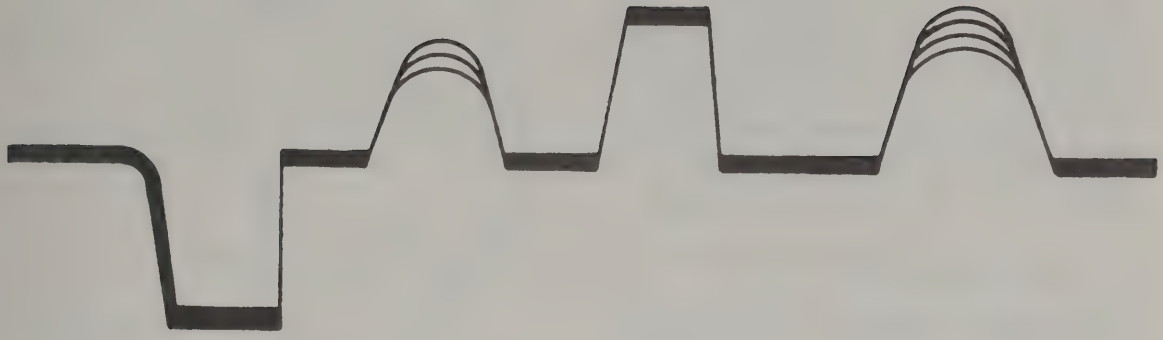


Figure 8. A-scope presentation.

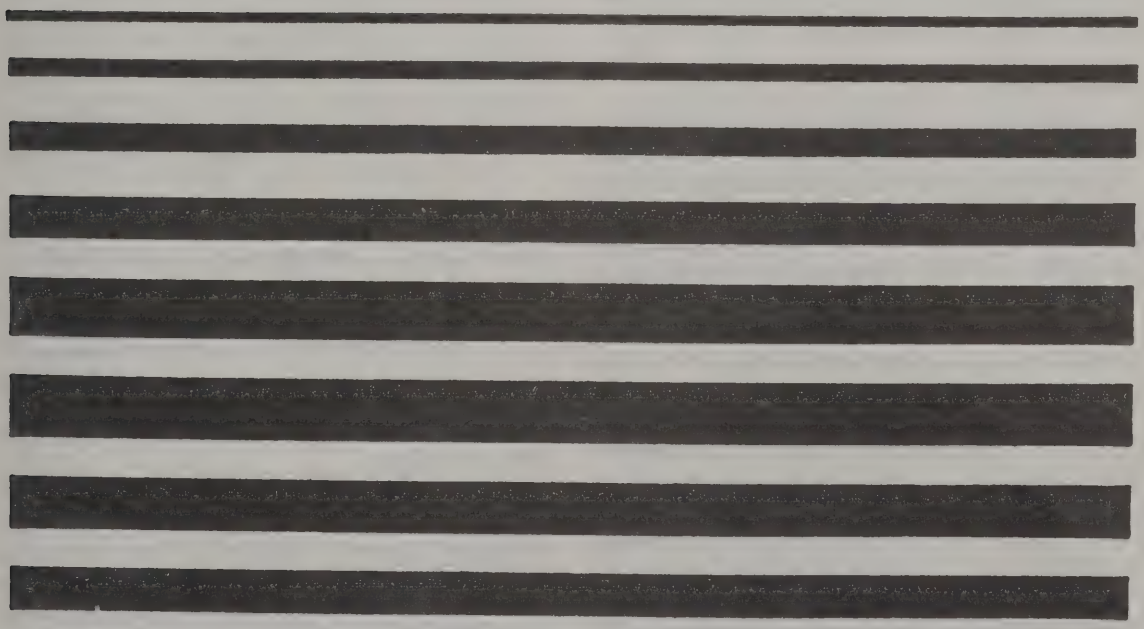


Figure 9. Audio presentation.

17. Emergency Stopping Procedure

a. In the shelter, turn off either the MAIN circuit breaker on the shelter power distribution box or the power switch on the power supply.

b. At the generator set place the VOLTS switch in its center or OFF position. Stop the engine.

Section III. ORIENTATION OF THE ANTENNA

18. General

To orient the antenna, it must be pointed in a direction of known azimuth, and this azimuth must be set on the AZIMUTH counter. Since the antenna cannot be pointed optically, a moving target is required to orient the antenna. This moving target is placed over an orienting point at a range great enough to be detected by the radar set. The moving target may be a helmet or a canteen swinging back and forth, a man running in place, a rotating reflector, or a similar device. For maximum results, the device should be rotated toward the antenna.

19. Preliminary Steps

a. Emplace the antenna so that it faces the area of interest and level.

b. Estalish an orienting point in the general direction of the area of interest and just beyond the minimum range (450 meters) of the set to insure maximum accuracy.

c. Determine the grid azimuth from the antenna to the orienting point.

20. Procedure

a. Turn the RADIATE switch to its ON position.

b. Declutch the plotting board arm by turning the locknut (small knob) in the center of the plotting board control knob counterclockwise, and center the plotting board arm, using the control knob (fig. 7).

c. Using the RANGE handwheel, set the RANGE to the approximate range of the orienting point.

d. Rotate the antenna until the AZIMUTH WARNING lamp lights, and note the direction of rotation (ccw or cw). Loosen the locknut on the SECTOR CENTER knob and rotate the white line on the flange in the same direction that the antenna was rotated until the line hits the limit stop. Note the azimuth counter reading at this point, then rotate the antenna 175 mils in the opposite direction and aline the mark on the flange with the reference line on the panel; then tighten the locknut on the SECTOR CENTER control knob. The line on the flange will indicate the direction that the antenna is pointing with respect to the limit stop (fig. 6). Figure 10 shows the position of the limit stops.

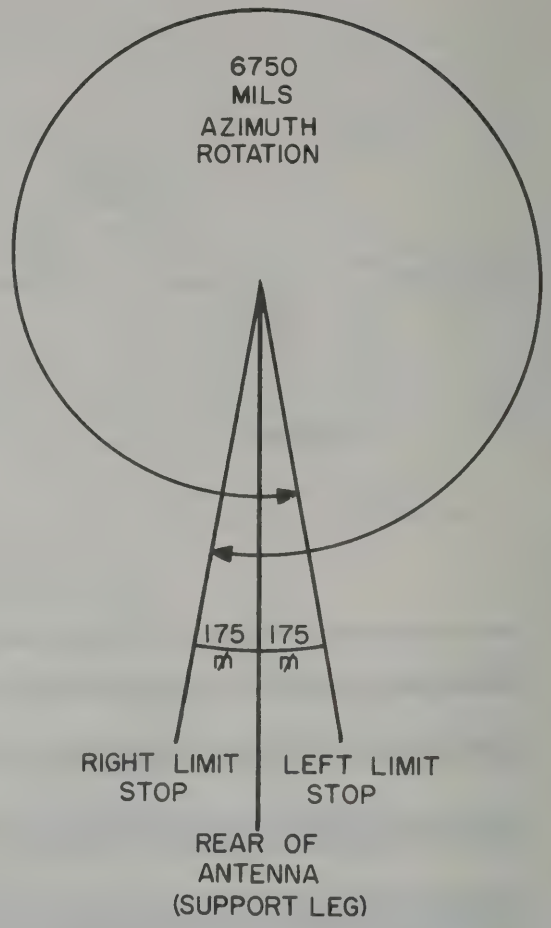


Figure 10. Azimuth coverage of antenna.

e. Turn the AZIMUTH handwheel away from the stop until the line on the SECTOR CENTER flange is 3,200 mils from the reference line on the control panel. The antenna then will be pointed toward the sector of interest. Estimate the angle between the center of sector and the orienting point. Rotate the AZIMUTH handwheel so that the position of the line on the flange corresponds to the position of the orienting point. The antenna then will be pointed approximately at the orienting point.

f. Place the AUTO-MAN switch in the MAN TRACK VIDEO position (mode 3). Search manually in azimuth, range, and elevation for the return from the orienting target. When the target is identified, peak the target return.

g. Move the AUTO-MAN switch to the MAN TRACK AUDIO (mode 4) or MAN TRACK VIDEO (mode 5) position and peak the target again with the narrow beam (36 mils wide). After peaking the return in mode 4 or 5, declutch the AZIMUTH ORIENTATION control by turning the locknut (large knob) clockwise and turning the control (small knob) sharply counterclockwise. Then set AZIMUTH counter to the azimuth of the orienting point by turning the AZIMUTH handwheel. When the AZIMUTH counter is set correctly, lock it by turning the azimuth orientation control (small knob) clockwise while holding the AZIMUTH andwheel and turning the locknut (large knob) counterclockwise.

h. Check the azimuth orientation by turning the antenna off the orienting target, repeaking the target return, and chekking the azimuth indicated on the AZIMUTH counter. It should indicate the azimuth to the orienting point.

Section IV. ORIENTATION OF MAP AND PLOTTING BOARD ARM

21. General

To provide a visual means of tracking moving targets, the map must be placed on the plotting board in such a manner that the indicator light will indicate on the map the acutal area on the ground that the radar is searching. To do this, the orientation of the antenna, the plotting board arm, and the map must be correlated. Since the indicator light on the plotting board arm is used as the indicator on the map, it also is used to locate and orient the map on the plotting board (fig. 7).

22. Preliminary Steps

The orientation of the map, the plotting board arm, and the X and Y counters must be performed after the antenna has been oriented. Two things must be known: The surveyed location of the radar antenna and the area of interest. Plot the antenna location on the map and indicate the area of interest. Draw on the map an azimuth reference line from the antenna location parallel to the grid line which passes closest to the area of interest. The azimuth of this line will be 0, 1,600, 3,200, or 4,800 mils. The plotting board arm which was unlocked by loosening the plotting board control knob locknut in antenna orientation still should be unlocked.

23. Procedure

a. Turn the RANGE handwheel fully counterclockwise to the minimum range.

b. Place the MAP ZERO switch on the right side of the radar set control in the ZERO position.

c. Manually rotate the range coupling between the radar set control and the plotting board until the RANGE counter indicates zero meters. This action should place the indicator light over the pivot point of the plotting board arm.

d. Rotate the plotting board arm to make sure that the indicator light is over the pivot point. The light should not move.

e. Place the map on the Plexiglas cover so that the plotted antenna location is directly over the center of the indicator light, with the area of interest approximately centered on the cover and with both reference lines on the plotting surface. The exact placement of the area of interest is not important, but the placement of the antenna location over the indicator light is critical.

f. Fasten the map in position with tape and either tear off or roll up any portion of the map which hangs over the edge of the plotting board.

g. Place the MAP ZERO (fig. 6) switch in the operating position (toward the bottom of the radar set control), and turn the RANGE handwheel until the indicator light is near the outer edge of the map.

h. With the AZIMUTH handwheel, set the azimuth of the reference line on the map (0, 1,600, 3,200, or 4,800 mils) on the AZIMUTH counter.

i. Using the plotting board azimuth control, position the indicator light directly under the azimuth reference line on the map and then tighten the locknut by turning it clockwise.

j. Run the range in and out; the indicator light must move along the azimuth reference line (fig. 11).

k. Turn to the azimuth of the second reference line and repeat the procedure in *h*, *i*, and *j* above. Mean out any difference in the azimuth readings.

l. Set the MAP SCALE switch to the appropriate scale for the map being used (1:25,000 or 1:50,000).

24. Use of Overlay Instead of Map

It is possible to use an overlay instead of a map on the plotting board. The overlay must show the radar position, the azimuth reference lines, and the area of interest. Place the overlay on the plotting board in the same manner as the map. Place the radar position over the indicator light at zero range with the points of interest toward the top of the board. Orient plotting board arm using the azimuth reference lines drawn on the overlay.

25. Orientation of the X and Y Counters

a. After the map and the plotting board have been oriented with the antenna and the AZIMUTH counter, the X and Y counters must be oriented to indicate the grid coordinates of the targets located. The grid reference of the antenna must be known to the nearest meter.

b. Set the ELEVATION counter to 0, move the RANGE counter to 0 as described in paragraph 23*a*, *b*, and *c*. Turn the X and Y counters clockwise until both the PLUS and MINUS windows open. Adjust the plus counters to read all zeros, and minus counters to read all nines; when their condition has been varified, cover the minus windows with masking tape. The counters are now ready to have grid coordinates of the antenna set in.

c. With the ELEVATION counter set at 0 mils, move the RANGE counter to 18,000 meters and the azimuth counter to either 0 or 3,200 mils, whichever is shown on the plotting board map. The radar easting coordinates are set in on the PLUS X counter by reducing the counter reading if the easting coordinates are over 50,000 or increasing the counter reading if the easting coordinates are under 50,000. Next set the AZIMUTH counter to either 1,600 or 3,200 mils, whichever appears on the plotting board map. The radar northing coordinates are set in on the PLUS Y counter be reducing the counter reading if the northing coordinates are under 50,000 or increasing the counter reading if the coordinates are under 50,000. Finally with the AZIMUTH and RANGE handwheels, position the indicator light on any grid intersection in the area of interest, the X and Y counters should indicate the coordinates of the intersection within 140 meters.

26. Calibration Check of the X and Y Counters

a. To check the calibration of the X and Y counters, set the ELEVATION counter to 0 and the RANGE counter to 18,000 meters. Set the AZIMUTH counter to either 0 or 3,200 mils, whichever is shown on the map on the plotting board. The Y counter should indicate 18,000 meters (± 140 meters) *more* than the radar northing coordinate if the azimuth was set to 0 mils, it should indicate 18,000 meters less than the radar northing coordinate if the azimuth was set to 3,200 mils. The X counter should indicate the radar easting coordinate. Set the AZIMUTH counter to either 1,600 or 4,800 mils, whichever is shown on the plotting board map. The X counter should indicate 18,000 meters (± 140 meters) *more* than the radar easting coordinate if the azimuth was set to 1,600 mils, or it should indicate 18,000 meters *less* than the easting coordinate if the azimuth was set to 4,800 mils. The Y counter should indicate the radar northing coordinates (± 140 meters).

b. Set the AZIMUTH counter to either 800 or 4,000 mils, whichever is shown on the plotting board map. Set the ELEVATION counter to 0 mils, and set the RANGE counter to 14,140 meters. The readings on both the X and Y counters should be 10,000 meters (± 75 meters) *more* than the radar coordinates if the azimuth was set to 800 mils or 10,000 meters *less* than the radar coordinates if the azimuth was set to 4,000 mils. Set the ELEVATION counter to ± 143 mils. The RANGE counter should indicate 14,000 meters (± 75 meters).

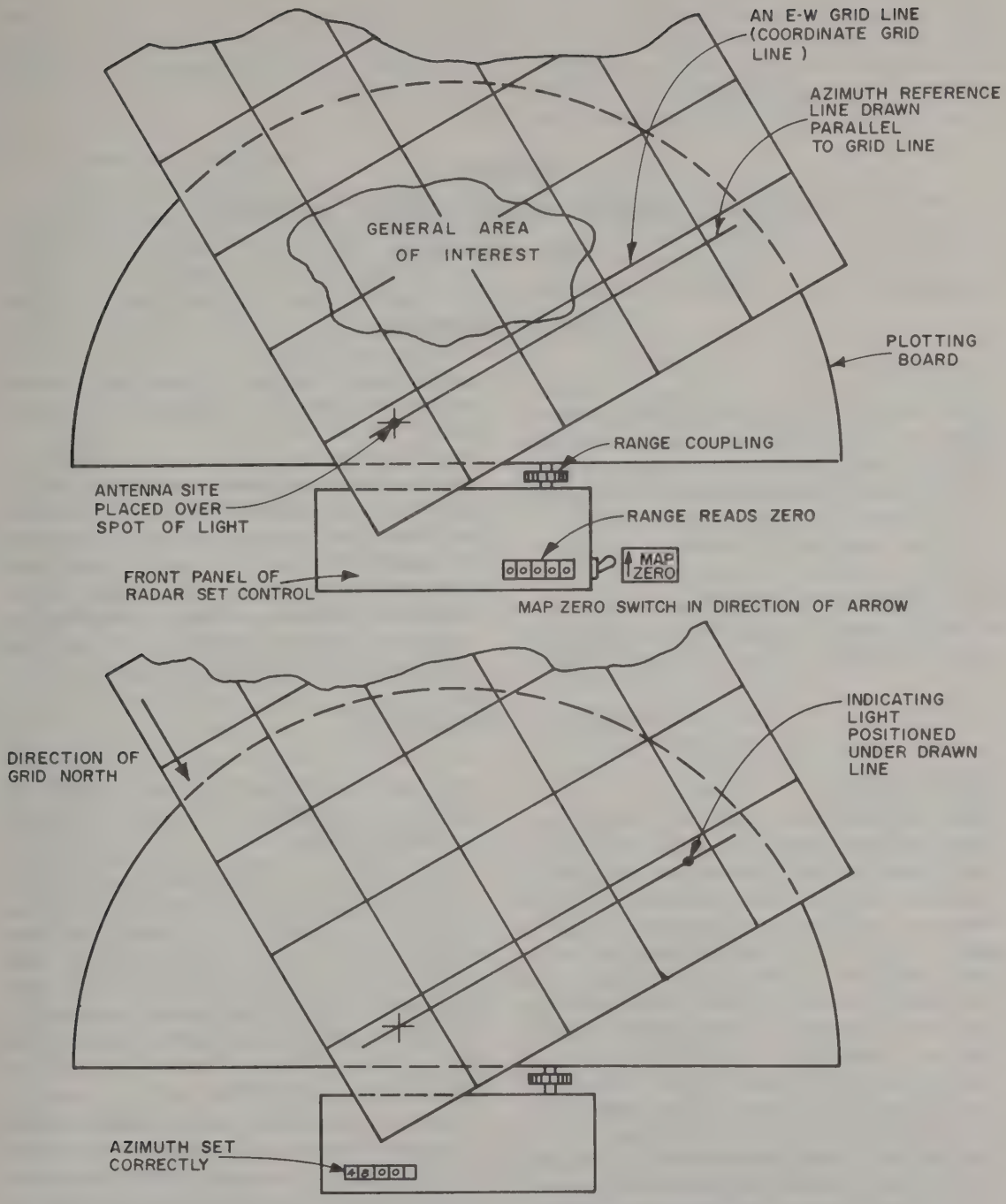


Figure 11. Orientation of map and plotting board arm.

CHAPTER 4
MOVING GROUND TARGET SEARCH, DETECTION, AND LOCATION

Section I. PERSONNEL

27. General

A well-trained crew is essential to insure accurate and timely locations of moving targets. The continuous operation normal to combat operations requires that each man in the section be capable of performing all the duties required for operation of the radar.

28. Utilization of Personnel

a. Except for the cheif of section and the radar mechanic, who are on call continuously, the personnel assigned to the radar section must be organized into teams for 24-hour operation.

b. Normally two men operate the radar set. One man operates the radar set control and the other operates the communication equipment and keeps the necessary records. These two men should exchange jobs approximately every 30 minutes to give each one a change of duty. The teams should be rotated by relieving one crewman at a time to allow the new personnel to become familiar with the situation.

Section II. OPERATION

29. General

The AN/TPS–25 radar section normally is employed to provide surveillance on the main avenue of approach into the division's area of responsibility. This section is assigned specific areas of surveillance (such as roads, trails, key terrain features, fords and passes where vehicular traffic will be canalized, bridges, road junctions, or areas of possible troop concentration) with definite limits in azimuth and range. This permits the radar operator to search for targets in greater detail and insure more timely detection of targets. The possibility of his detecting a target in a wide general area bounded by several hundred mils in azimuth and several thousand meters in range is very remote, due to the unlikely chance of his bearing a target echo as the 75-meter range gate passes briefly over a fleeting target.

a. The technique employed in detecting and locating moving ground targets with AN/TPS–25A may be divided into two phases—the search, or surveillance phase, and the location, or tracking phase.

b. A sector(s) of interest normally is assigned to the radar. The azimuth, elevation, and range to the sector of interest are determined. The azimuth is set off on the AZIMUTH counter. The SECTOR WIDTH selector switch is set for the desired sector width. The range counter is set to the minimum range of the sector of search. The elevation is set on the ELEVATION counter.

c. The set is designed for five modes of operation; each mode is indicated on the control panel and may be selected by turning the AUTO MAN selector switch to the numbered position corresponding to the desired mode of operation. Three mades—AUTO SEARCH (position 1), AUTO RANGE (position 2), or MAN SEARCH (position 3)—may be used to detect and locate targets. MAN SEARCH (po-

sition 3) is the preferred mode for the surveillance of specific points (e.g., road junctions, possible command post areas, and avenues of approach) within the area of interest.

30. Battlefield Surveillance

a. AUTO SEARCH MODE. When the AUTO-MAN selector switch is placed in position 1 (AUTO SEARCH), the antenna will go into sector scan, using the 180-mil beam. The azimuth dials move to show the azimuth at which the antenna actually is pointing and the sector scan indicator lamps indicate the direction of rotation of the antenna. The range gage automatically searches a 900-meter range sector, starting at the range shown on the RANGE counter and strobing outward. The indicator (cathode-ray tube) presents an A-scope display of ranges from 100 meters less than the counter reading to 1,000 meters more than the counter reading. The audio return from moving targets in the range gate can be heard in the earphones and/or the loudspeaker.

b. AUTO RANGE MODE. When a moving target is detected, the AUTO-MAN selector switch is changed to position 2 (AUTO RANGE). The antenna stops scanning (does *not* return to center of sector), and the ccw or cw indicator lamp, which was on when the set was taken out of sector scan, stays on and indicates the direction of last rotation. The range search continues as before. If the target no longer is heard at any point during the range search, the operator turns the AZIMUTH handwheel slowly in the direction *opposite* that indicated by the sector scan indicator lamp (the antenna apparently passed the target before the operator took it out of sector scan). Since the range search covers 900 meters, the operator watches the A-scope, notes the location of the range gate when the moving target is heard in the earphones, and estimates how much the RANGE counter setting must be changed to indicate the range to the target.

c. MAN SEARCH MODE. When the azimuth and approximate range to the target have been determined, the AUTO-MAN switch is moved to position 3 (MAN SEARCH). The RANGE, ELEVATION, and AZIMUTH handwheels are adjusted for maximum (loudest) moving target return. This produces an approximate target location. However, up to this time, the antenna beam width has been 180 mils and any locations made are considerably less accurate than the set is capable of producing.

31. Moving Ground Target Location

a. After an approximate location has been determined in mode 3, either mode 4 or mode 5 or both may be used to obtain an accurate target location.

(1) *MAN TRACK AUDIO MODE.* When a moving target has been located in the wide beam, the operator switches the AUTO-MAN selector switch to position 4 (MAN TRACK AUDIO). This position changes the antenna beam width to 36 mils and changes the presentation on the cathode-ray tube so that it displays the audio signal. The azimuth, range, and elevation are reset to obtain a maximum moving target indication. The target strength is indicated by the distance between the outer horizontal bars shown on the A-scope. The target location (either grid or polar coordinates) is recorded and reported.

(2) *MAN TRACK VIDEO MODE.* When a target is moving rapidly, it may be difficult to track in the MAN TRACK AUDIO mode of operation, as there is no indication whether movement is in range or in azimuth. In such cases, the operator should change the AUTO-MAN selector switch to position 5 (MAN TRACK VIDEO). The beam width remains at 36 mils, but the cathode-ray tube presents the normal A-scope display, and the moving target can be distinguished from stationary targets by its appearance on the A-scope. The size of a moving target echo fluctuates rapidly, in a "spider-web" design, but the size of a stationary target echo remains relatively constant. Any change in the range of the moving target will be visible on the A-scope. Therefore, any change in target location which does not appear as a range change must be a change in azimuth, and the operator can reposition the AZIMUTH handwheel to track the target. The use of the MAN TRACK VIDEO mode helps the operator to determine the direction of movement and facilitates the tracking of fast-moving targets.

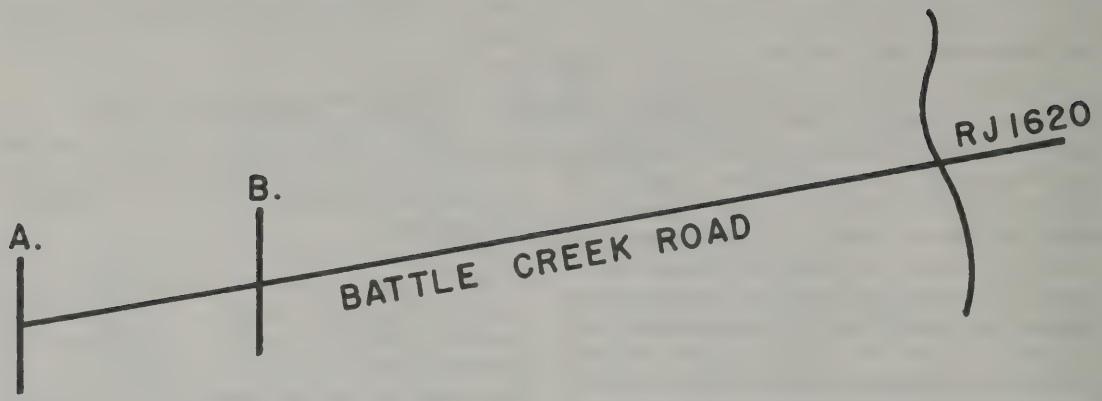


Figure 12. Predicted target location.

b. After tracking a target for 30 seconds, the radar operator can determine the speed of the target, predict the time that the target will arrive at a given point (e.g., a road junction or a suspected rendezvous area), and request artillery fire on that point. He determines the speed of the target by measuring on the map the distance the target traveled during a specific period of time and then computes the time that the target will arrive at the selected point.

Example: Assume that the operator is tracking a target traveling on Battle Creek Road towards RJ 1620 (fig. 12). After the operator has peaked the target return in mode 4 or 5 and is tracking the target satisfactorily, he makes a pencil mark at the leading edge of the indicator light at point *A*. With a stop watch or a clock, he times the movement of the target for 30 seconds and marks the leading edge of the indicator light at point *B*. By measuring the distance the target traveled from point *A* to *B* and the distance the target will travel from point *B* to RJ 1620 the predetermined point, with a plotting scale, he predicts the time the target will arrive at RJ 1620 by the formula—

$$\frac{\text{Distance from } A \text{ to } B}{\text{Travel time from } A \text{ to } B} = \frac{\text{Distance from } B \text{ to selected point}}{X \text{ (predicted time)}}$$

(always 30 seconds)

Given:

Distance from point *A* to point *B* = 400.

Distance from point *B* to RJ 1620 = 2000.

Solution:

$$\frac{400}{30} = \frac{2000}{X} = \frac{60{,}000}{400X} = \frac{150}{}$$

Therefore, X = 150 seconds, or 2.5 minutes.

c. It may be necessary to record the speed of targets in miles per hour. A simple conversion can be applied to the measurement in meters to determine the approximate speed in miles per hour. The distance that the target travels in 30 seconds is measured in meters. A target traveling at a speed of 5 miles per hour covers 65 meters in 30 seconds. Therefore, if a vehicle

travels 130 meters in 30 seconds, it is traveling 10 miles per hour. The speed in miles per hour is equal to the number of meters traveled in 30 seconds divided by 13.

32. Additional Capabilities

The radar set AN/TPS–25 can perform several missions in addition to detecting and locating targets for artillery. The missions which can be performed are limited only by the ingenuity and imagination of the operators and those who are responsible for planning the missions. Some of the additional ways that the AN/TPS–25 can be used to provide battlefield information are:

a. Provide traffic analyses for intelligence personnel. Such information possibly could indicate reinforcement or evacuation of specific areas.

b. Survey areas for detection of air defense installations. Rotating antennas commonly are used in conjunction with air defense radars. The AN/TPS–25 radar can detect the movement of an antenna and pinpoint its location.

c. Survey the effects of both nuclear and conventional artillery fire to detect any activity immediately after firing. Areas previously fired on may be monitored to ascertain whether activities have been resumed.

d. Vector combat elements or reconnaissance patrols to predetermined areas in unfamiliar terrain or during hours of darkness. When this mission is assigned to the radar section, close coordination between the radar operator and the patrol (combat element) must be established by using one or all of the following means:

(1) Communications must be by coded message.

(2) Checkpoints and time schedules must be established.

(3) Prearranged signals recognizable by the radar operator must be known; for example, the swinging of a helmet or metal object a specified number of times.

CHAPTER 5

TACTICAL EMPLOYMENT AND POSITION REQUIREMENTS

33. General

The tactical employment and position requirements for the radar set AN/TPS–25 will depend on the tactical mission assigned the radar section and on the technical and tactical factors which must be considered to insure maximum effective operation. The complete suitability of a radar site, however, can be determined only by operation from that site.

34. Selection of the Radar Site

a. The primary considerations in selecting a radar position are the primary mission of the radar section and the technical capabilities and limitations of the radar set.

b. In the division artillery, the general position area within which the target acquisition platoon leader may select positions is designated by the division artillery S2. The area should be large enough to enable the target acquisition platoon leader, field artillery radar technician, or chief of section to select the actual radar site based on the technical considerations affecting the operation of the radar. The position selected should simplify communications, facilitate survey and logistics, and enable the section to take advantage of any defensive perimeter. Depending on the mission, terrain, and situation, the radar position area should be located from 1,000 to 2,000 meters behind the forward edge of the battle area. This location would give the radar section flexibility of action in both the offense and defense. During an offensive action, the position should be well forward to avoid early displacement. In the defense, the position should be located farther to the rear to provide depth to the radar operations of the defensive force as a whole.

c. After being informed of the general area in which to locate the radar, the target acquisition platoon leader (or chief of section) will make a reconnaissance prior to selecting the actual position. If time permits, this reconnaissance will be divided into two phases—a map reconnaissance and a ground reconnaissance.

(1) The map reconnaissance is made to determine, but is not limited necessarily to, the following:

(*a*) Routes of approach into and out of the area.

(*b*) Identifying landmarks.

(*c*) Adjacent units.

(*d*) Possible radar positions.

(2) A ground reconnaissance should follow the map reconnaissance in order to insure a rapid occupation of the selected position. The ground reconnaissance is based on tactical and technical considerations which influence radar operations, and it enables the target acquisition platoon leader (or chief of section) to make decisions and issue orders concerning the following:

(*a*) Exact location of the radar.

(*b*) Location of the generator.

(*c*) Location of the vehicles.

(*d*) Routes of entrance to and exit from the area.

(*e*) Searching and marking the area for mines.

(*f*) Local security (to include camouflage and defense against air and ground attack).

(*g*) Selection of alternate positions.

Note. The above list is not all-inclusive and should be modified as required by the particular mission, the situation, and the terrain. The time for reconnaissance generally is limited. The reconnaissance must be organized so that it can be accomplished in the allotted time.

35. Tactical Considerations

a. The tactical considerations in selecting a radar site are the same as those considered in choosing a position for a field artillery firing battery or similar unit. The main tactical considerations are discussed below:

(1) *Accessibility.* To be utilized, the radar site must be accessible.

(2) *Communications.* The communications requirements will vary depending on the mission assigned to the radar section, but the site must permit the required communications to be established. Wire and/or radio are normal means of communication for the radar section. A typical communications diagram for a surveillance radar section is shown in FM 6–10.

(3) *Concealment.* In selecting a site for the radar, advantage must be taken of natural concealment, such as trees and shrubs. (Concealment must be light enough not to interfere with the radar beam.)

(4) *Cover.* The radar, with the exception of the antenna, must be emplaced in defilade to the enemy to afford personnel and equipment all possible protection from hostile fire.

(5) *Routes of approach.* A site should be selected that has more than one covered route of approach, preferably routes that will allow occupation unobserved by the enemy. Road conditions, overhead clearances, bridges, and stream fords also must be considered.

(6) *Security.* The target acquisition platoon leader (or chief of section) should attempt to locate a site within some other unit's perimeter of defense. This will ease his local security problems.

(7) *Survey.* The closer the radar site is to a known survey point, the more rapidly survey personnel or organic personnel can determine the coordinates and altitude of the radar and the azimuth and elevation to a known point for orientation purposes.

(8) *Logistical support.* The target acquisition platoon leader (or chief of section) should attempt to locate the radar within or near another unit's area and establish liaison with the unit commander. Such a location would facilitate for radar section logistical support (messing, resupply, etc.).

b. The radar set AN/TPS–25 frequently will be emplaced during darkness or periods of poor visibility. Consequently, tactical considerations, such as communications, survey, local security, and routes of approach, will require a great deal of planning and preparation. As visibility improves, camouflage and concealment will become an important consideration. Cover from enemy fire will be virtually nonexistent for the antenna, since the radar set requires line of sight to the target area.

36. Technical Considerations

The technical considerations in selecting a radar site are as follows:

a. Line of sight to the target area is a mandatory requirement for the antenna location. The antenna is 25 feet above the ground when it is installed on three mast sections. It can be employed with one, two, or three mast sections, or it can be installed directly on the transmitter-receiver.

b. A suitable location for the shelter (or its contents, if the set is operated outside the shelter) must be selected within 225 feet of the receiver-transmitter. Two 100-foot cables and one 25-foot cable are provided for connecting the receiver-transmitter and the shelter (coordinator), and permit a maximum distance of 225 feet between the two components. Further consideration must be given to locating the power unit within 100 feet (the length of the power cable) of the shelter.

c. The power unit should be located so that the noise and smoke will not disturb the radar operator and so that the unit cannot be located easily by the enemy.

d. The site selected must be close enough to the area of interest to enable the radar to detect the type of target specified by the mission.

e. The target aspect should be considered in siting the radar equipment. The AN/TPA–25A radar detects the movement of an object only when the object moves in range, and the detection of motion is much easier when the motion is directly toward or away from the radar.

37. Site Evaluation

a. Since the overriding technical consideration in the selection of a radar site for moving target detection is an electronic line of sight, the radar section chief should, before occupy-

ing a radar site, construct a hasty visibility profile to determine whether the assigned target area can be covered by the radar set. Effective use of a profile can save valuable time by exposing a useless position.

b. After a position is occupied a more detailed visibility profile can be developed into a horizontal coverage overlay. This overlay is provided to the division artillery S–2 for construction if a target acquisition capabilities chart. A copy of the overlay also is placed at the radar plotting table of the operations use.

c. The evaluation of a radar site to determine its probable suitability for the detection and location of moving ground targets can be accomplished by constructing a series of profiles. From the profiles, a horizontal coverage diagram can be constructed to show the areas that are masked or hidden from the radar. Since the area of interest assigned to the radar section may cover a wide angle, a map study should be made of the area. Close attention should be given to points of interest, such as roads, road junctions, and possible points of troop concentration, in the area of responsibility.

d. The study of land forms by a visual examination of the contour lines is adequate for many purposes, but a profile usually is required when precision is demanded. A profile is an exaggerated side view of a portion of the earth's surface along a line between two points.

e. To plot the masked or hidden areas, a series of profiles must be made through the area of interest. The number of profiles to be drawn will be determined by the terrain and the assigned area of interest. Profiles must be constructed in a series by starting at one edge of the assigned sector and placing one profile below the other. The forward and rear limits of the masked areas then can be determined by drawing straight lines from the radar position to and past the highest points on the profile. When the masked areas have been determined, they can be projected to a horizontal plane by extending the visible points on the profiles to an overlay as shown in figures 13 and 14.

f. A profile can be constructed from any contour map but only along a straight line. The procedure is as follows:

(1) Draw a straight line on the map along the line from which the profile is desired (fig. 13). This line is the profile line.

(2) Determine by examination the values of the highest and lowest contour lines that cross or touch the profile line. Add one contour value above the highest contour line and add one below the lowest contour line to take care of the hills and valleys.

(3) On a blank sheet of paper, draw equally spaced horizontal lines. Draw enough lines so there will be one line for each contour value determined in (2) above. Do this for each profile line as shown in figure 14.

(4) Placed the lined paper on the map with the top line adjacent and parallel to the profile line.

(5) On the lined paper, number the line closest to the profile line with the highest value determined ((2) above).

(6) Number the rest of the lines in sequence down to the lowest value on the line farthest from the profile line.

(7) From each point where a contour line crosses or touches the profile line, drop a perpendicular line to the line with the same value as the contour line. Place a tick mark where the perpendicular line crosses the line.

(8) Determine the highest point of a hill and the lowest point of a valley by interpolation. Drop a perpendicular line to the interpolated values.

(9) Compute the second profile in the same manner as the first. Move the straightedge clockwise from the first profile line and look for major contour changes in the terrain. When a contour line is crossed that might block the visibility between the radar site and the area of interest, hold the straightedge at this position and plot the points as previously explained. Continue procedure until the complete area of interest has been inspected. The number of profiles drawn to any one area may vary from two to a great number depending on the terrain and the width of the area.

(10) After all perpendiculars have been dropped to the lined paper, connect all tick marks with a smooth, natural curve following the contour of the terrain as shown in figure 15. Hills and valleys usually are rounded. Streams, usually form a sharp V-shape. Fi-

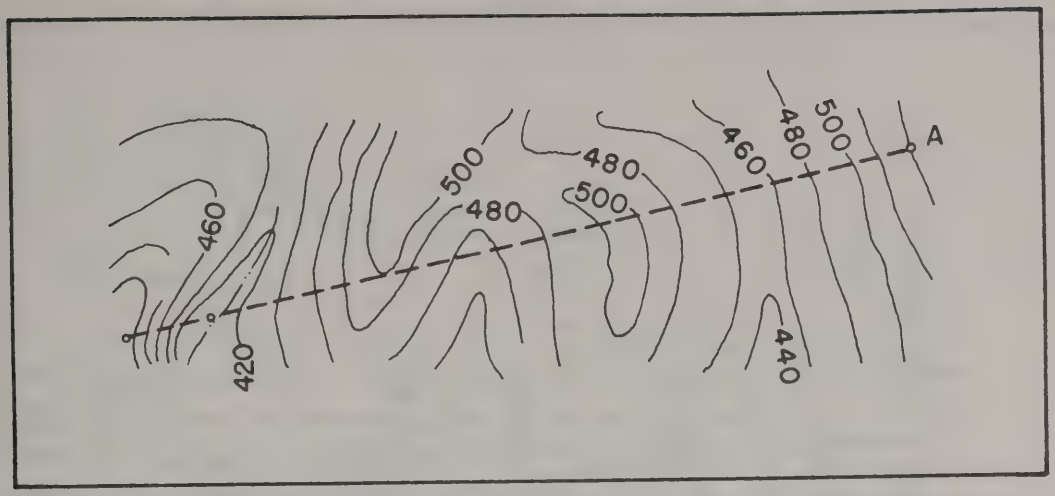


Figure 13. Map and profile line

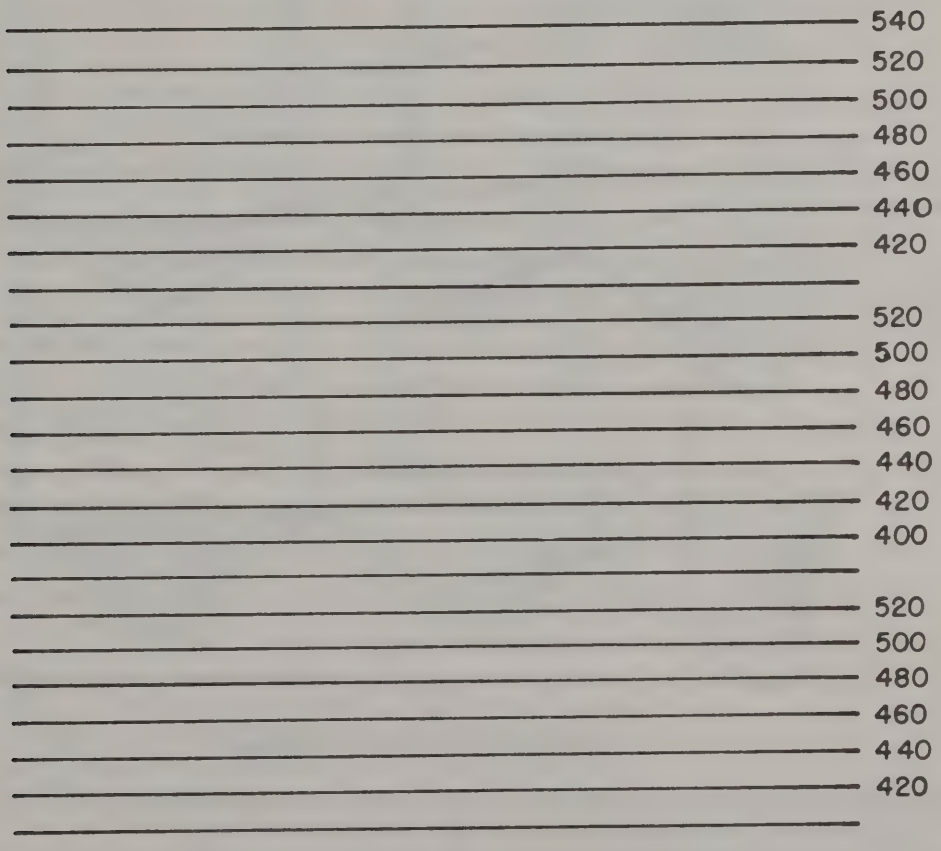


Figure 14. Lines for construction of visibility profiles

(Text Key : Para 37)

Figure 14. Lines for construction of visibility profiles.

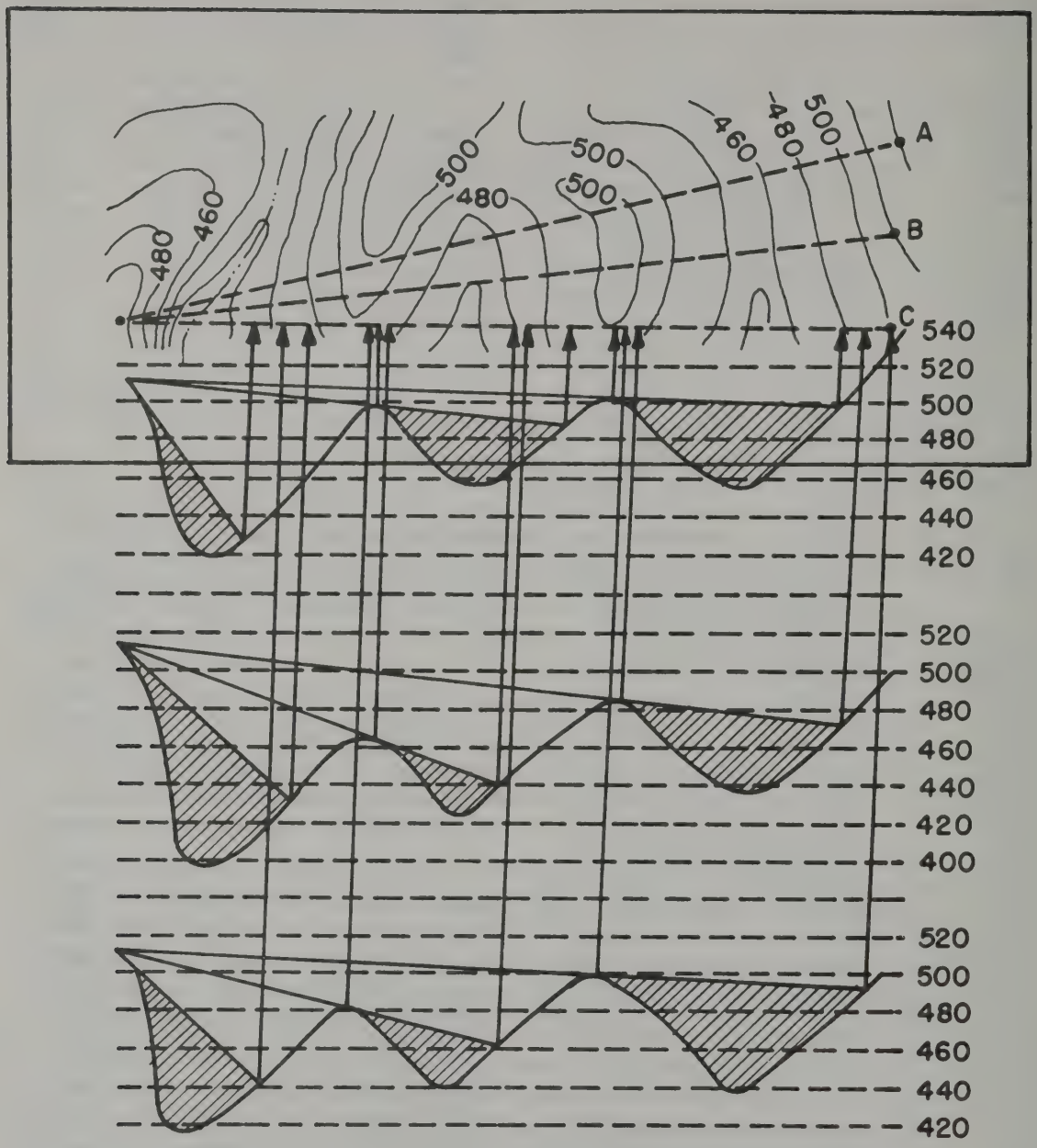


Figure 15. Series of visibility profiles.

gure 15 shows the lined paper placed adjacent and parallel to the third profile line for the construction of the final profile.

(11) Lay a straightedge from the radar position across the top of each ridge and shade in the area beyond the ridge and below the straightedge (fig. 17).

Note. (1) The profile just drawn may be exaggerated. The amount of exaggeration varies with the amount of space between the lines drawn in (3) above. A 1:50,000 map with a contour interval of 20

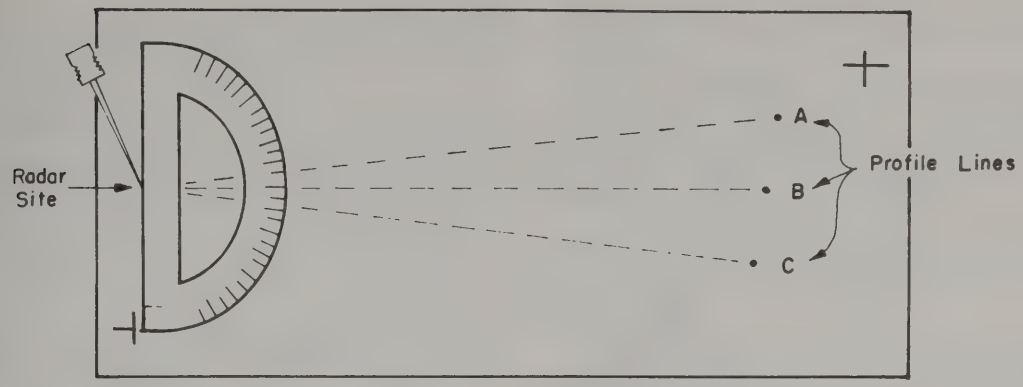
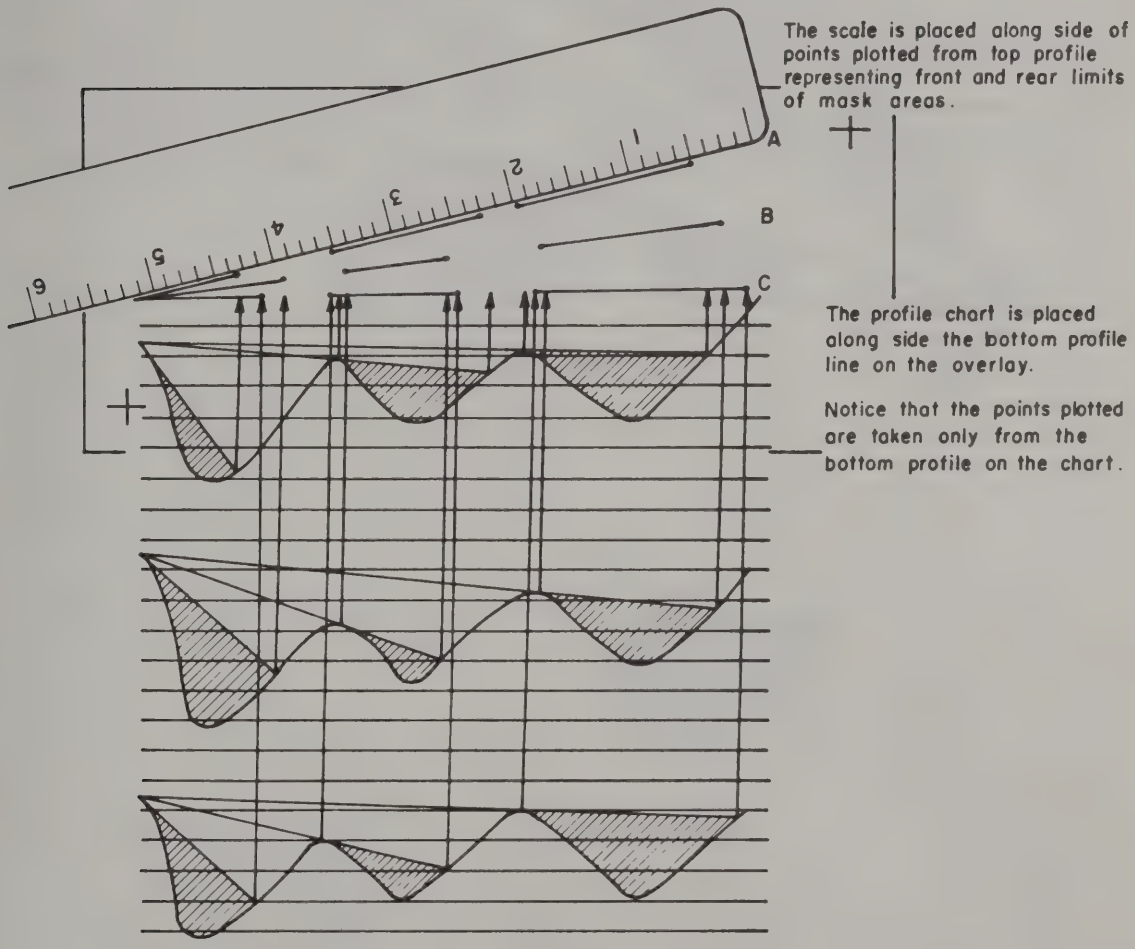


Figure 16. Coverage overlay


The scale is placed along side of points plotted from top profile representing front and rear limits of mask areas.
A
B
C
1
2
3
4
5
6
The profile chart is placed along side the bottom profile line on the overlay.
Notice that the points plotted are taken only from the bottom profile on the chart.

17 Series of visibility profiles
(Text Key : Para 37)

Figure 17. Series of visibility profiles.

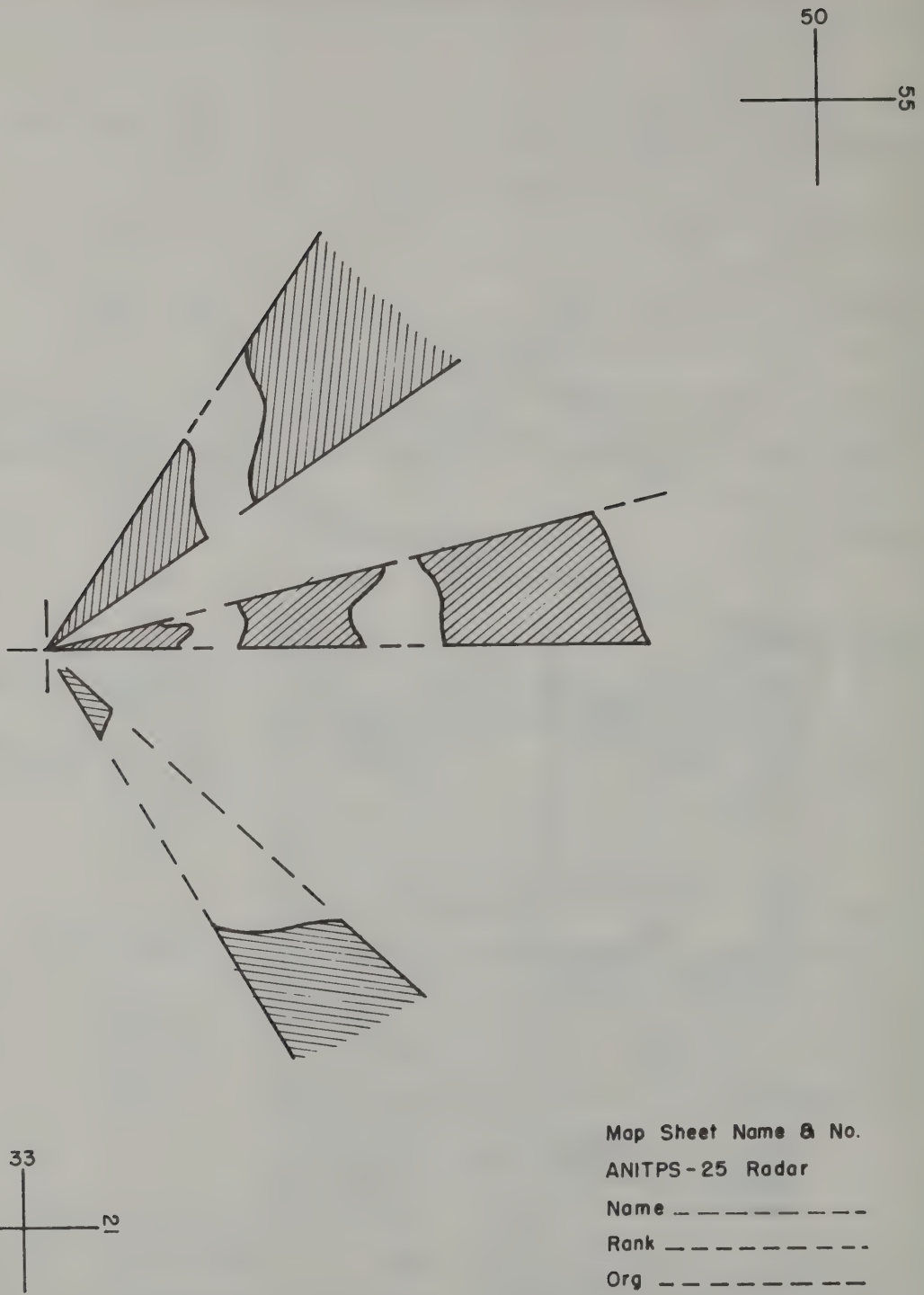


Figure 18. Horizontal coverage overlay.

feet would require a line spacing of 0.0048 inch to give no exaggeration. Any spacing greater than this would cause an exaggeration of the profile.

(2) When speed is the most important element or where a complete profile is unnecessary, a profile may be constructed, that shows only the hill and ridge tops and, if desired, the valleys. This is called a hasty profile. It is constructed in the same manner as a full profile.

g. A horizontal coverage diagram shows the areas that are masked or hidden from the radar. It is constructed on overlay paper from visibility profiles in the following manner:

(1) Plot a tick mark on one edge of the overlay to represent the radar position.

(2) Measure the angle from the radar position to either side of the area to be searched and to each profile line, and plot these points on the overlay (fig. 16).

(3) Lay the first profile at the top of the scale along the left edge of the angle plotted in (2) above.

(4) Plot a point on the overlay at the end of each of the vertical lines marking the front and rear limits of the masked or shaded areas that appear along the top profile and draw a straight line between these points.

(5) Repeat the step in (4) above for each profile. The result should be a series of marks representing the masked area along each profile (fig. 14).

(6) Connect the ends of the lines in each profile representing the shaded areas to the adjacent profiles and then shade in the area between the profiles to show the terrain that is in defilade to the radar.

(7) The procedure in (1) through (6) above is performed on each area of interest as shown in figure 18. When the marginal information has been entered on the overlay, it is ready to be submitted to the division artillery.

CHAPTER 6

SAFETY PRECAUTIONS

38. Principles

Using personnel will not perform maintenance or inspections on the radar equipment beyond those specifically authorized in this manual and in the applicable technical manual.

39. Precautions

a. High Voltages. Dangerous voltage is used in the operation of the radar equipment. Be careful when working on or near the 300-watt plate and power supply circuit or on the 115-volt AC line connections. Extremely high voltages exist in the following units:

Radar modulator MD–344/TPS–25.	3,800 and 7,600 volts DC.
Radar receiver-transmitter RT–500/TPS–25.	−750, −760, 3,800 and 16,00 volts DC.
Radar set control C–2715/TPS–25.	2,000 volts DC.
Power supply PP–2166/TPS–25.	845 volts AC.
Servo data coordinator SN–231/TPS–25.	1,000, 2,000 volts DC.

b. Gasoline. The engine generator should not be refueled when the radar is transmitting, and gasoline containers should not be handled or left open in the vicinity of the radar set. Plastic containers should not be used for refueling (static electricity may cause sparks).

c. Radiation Hazard. Radio-frequency (RF) energy transmitted by the radar set can produce severe burns. Radiation levels extremely dangerous to personnel exist in the radar beam up to a distance of 40 feet from the antenna.

d. Radioactive Material. Radioactive material is contained in electron tubes Bomoc part # BL–71/6564 used in the radar set. These tubes are potentially dangerous to personnel when broken. If handling personnel are cut by a broken tube, emergency medical attention is required. For specific instructions, see TB SIG 225.

e. Poisonous Selenium Compounds. Selenium rectifiers are used in the receiver-transmitter RT–500/TPS–25. Failure of these rectifiers can result in the liberation of poisonous fumes and the deposit of poisonous selenium compounds. If a rectifier burns out or arcs over, a strong odor is released. Provide adequate ventilation immediately. Avoid inhaling the fumes and do not handle the damaged rectifier until it has cooled.

40. Electric Shock

Electric shock casualties may stop breathing. A casualty may recover if artificial respiration is applied promptly and efficiently. The principles and procedures for treating electric shock are described in FM 21–11.

CHAPTER 7

PROCEDURES FOR MINIMIZING THE EFFECTS OF JAMMING

41. Electronic Countermeasures

Electronic countermeasures as applied to radar include the measures, tactics, and techniques used by the enemy to reduce or nullify the effectiveness of our radar equipment. Such activities can be subdivided into two principal categories, passive countermeasures and active countermeasures.

a. Passive Countermeasures. Passive countermeasures consist of the means and methods used by the enemy to determine the technical and operational characteristics of opposing radars. By means of monitoring equipment, the enemy can intercept and analyze radar signals to determine the transmission frequency, the pulse repetition frequency, the power output, and other technical characteristics of a radar set. From this information, the enemy can make a reasonable determination of the types and probable uses of opposing radars. The information gained from passive countermeasure activity also is used by the enemy in planning his active countermeasure operations. Passive countermeasures, however, do not affect a radar set directly and, consequently, are not a principal concern of the radar operator.

b. Active Countermeasures. Active countermeasures are the immediate concern of the radar operator, because their application directly affects the operational effectiveness of the radar set. These countermeasures are divided into two classes, jamming and deception. The two classes are divided further into two types, transmission and reflection.

(1) *Transmission jamming.* Transmission jamming is produced by an active transmitter operating at or near the radar frequency. The jamming signal may be a straight, continuous wave (CW) signal, frequency modulated (FM) and/or amplitude modulated (AM) by a variety of different waveforms. The jamming also may be produced in "barrage" form (a number of jammers tuned to adjacent frequencies jam a large segment of the frequency band) or in "swept frequency" form (the frequency of the jamming transmission is swept or varied over a portion of the radar frequency band). The purpose of all jamming is to jam the radar receiver with signals of sufficient strength to obliterate the return echoes from targets in the area of surveillance. To be successful, the jammer must produce signals that will be accepted by the radar receiver and produce these signals in a strength that will be greater than the target return signals. The relative power of the jammer and the radar transmitters and the distance between these two transmitters are important factors in countermeasure operations.

(2) *Reflection jamming.* Reflection jamming is produced by large numbers of reflecting items that efficiently return echoes of the transmitted radar signal to the radar set. Like transmission jamming, reflection jamming is intended to flood the radar receiver with strong signals that will overshadow the real target echoes.

(3) *Transmission deception.* Deception differs from jamming in that the deception signals are intended to confuse the radar operator by presenting false targets instead of overshadowing the real target echoes. Transmission deception signals, for the most part, are produced by transmitting devices known as repeaters. These repeaters are triggered by the radar transmitter signal and respond with one or more pulses of energy at the radar frequency. The repeater pulses appear to the radar set as return echoes of its own transmitted pulse. This type of countermeasure often is referred to as "spoofing."

(4) *Reflection deception.* Reflection deception signals, like transmission deception signals, are intended also to appear as real target echoes. In most instances, these signals are produced by small rotating or mobilized corner reflectors that reflect back to the source any radar signals they intercept.

42. Counter-Countermeasures

The tactics, techniques, and procedures designed and employed to reduce the effectiveness of enemy countermeasures are called counter-countermeasures. Usually, counter-countermeasure applications, whether used against jamming or deception, are called antijamming, or AJ, procedures or operations. The responsibility for AJ operations lies almost entirely with the radar operator. It is of the greatest tactical importance that the radar operator be able to detect and minimize the effectiveness of enemy countermeasures. Whether or not enemy countermeasures are effective will depend, to a great extent, upon the positive AJ action taken at all echelons by commanders and staff officers, signal and communication officers, technical supervisors, and radar operators. AJ measures must be included in all planning and AJ activities must be controlled and coordinated. The radar operator must be trained thoroughly and continuously to expect countermeasures, to recognize the difference between countermeasure effects and equipment malfunction or other interference, to be able to identify various types of countermeasures, to make adequate countermeasure reports, and to continue operation while under a countermeasure attack.

43. Countermeasure Identification

Noise or unusual disturbances do not always indicate countermeasure activity. It may be natural interferences resulting from atmospheric disturbances, unintentional interefference by friendly equipment, or malfunction of the equipment.

a. Need for Identification. After an interfering signal has been recognized as a countermeasure signal, immediate and accurate identification of the signal characteristics is essential. It is important that identification be made before AF action is taken for the following reasons:

(1) AJ techniques are based on both the types of countermeasures received and the characteristics of the countermeasure signal. Application of the recommended AJ procedure against a specific type of countermeasure signal is most likely to enable the radar operator to operate through the countermeasure signal.

(2) The systematic identification of the countermeasure signal characteristics and the prescribed use of AJ devices and equipment controls save time. The radar operator must avoid haphazard knob twisting.

(3) Accurate identification, including location information, will be useful to higher headquarters in determining countermeasure signal sources and the enemy countermeasure potential.

b. Natural and Unintentional Interference. Unintentional interference sometimes is caused by friendly radio sets, radar sets, or other electronic equipment. Natural interference can result from electrical disturbances in the atmosphere. As a general rule, natural or unintentional interference is not as persistent as intentional interference and does not have the regularity of pattern or the directional characteristics usually evident in intentional interference or countermeasure signals. Harmonic interference occurs when a signal from an external source, a multiple or submultiple of the radar operating frequency also is accepted by the radar receiver. When the harmonic interference contains readable intelligence, the origin of the signal usually can be determined.

c. Deception. Because deception signals appear to be real target echoes, skillfully generated transmission deception usually is very difficult to recognize and identify.

(1) *Transmission jamming.* If the jamming signal is produced at the radar set frequency to affect only that frequency, the result is called spot jamming. Spot jamming, which permits the jammer to concentrate all his power at one frequency or in a very narrow frequency band, is difficult to work through. The jamming may produce a crackling and rushing noise in the earphones and will cause the radar scope to "blossom" brightly with noise indications. These jamming indications

are very much alike whether continuous wave jamming signals or modulated jamming signals are used. The amount of noise present, both aural and visual, varies as the strength of the jamming signal varies. The effects of barrage jamming are similar to those of spot jamming. Sweep jamming (or sweep frequency jamming) produces sounds resembling a rushing wind coming and going and causes a recurring brightening of the scope. Each time the jamming frequency, in its sweep, coincides with the radar frequency, the jamming indications are evident. All types of jamming have directional characteristics; that is, the jamming is stronger or more evident when the radar antenna is facing the location of the jammer.

(2) *Reflection jamming.* Reflection jamming usually is produced by large numbers of small pieces of reflecting material that produce radar indications similar to target returns.

(3) *Transmission deception.* The most common type of transmission deception used against surveillance radars is spoofing (para 41*b*(3)). The deception signals, usually produced by a repeater type transmitter, produce radar indications that appear as a series or line of targets. In some cases, the signals may be identified as deception signals by their comparative perfection; that is, the uniformity of the amplitude and spacing of the signals. If the radar operator has been trained thoroughly to recognize the various target indications normally encountered (personnel, tanks, trucks, etc.), he may be able to distinguish the aural indications of the deception signals from normal target indications. Also, the movement, if any, of the deception signals should differ greatly from that of real targets. The radar operator's greatest aid in recognizing transmission deception is a thorough knowledge of both aural and visual indications of the various types of real targets.

44. Counter-Countermeasure (Antijamming) Operation

Since the success of a military operation may depend on information obtained by radar equipment, the radar operators are called on to maintain operations during enemy countermeasure attacks. While not all AJ measures are the responsibility of the radar operator, he is responsible for doing everything within his capability to accomplish his mission. For example, if enemy countermeasures are used against the AN/TPS–25 radar while it is either searching for a target or tracking a target, the procedures given in *a* and *b* below may be used by the operator to reduce the effects of any countermeasures.

a. Search Mode Antijamming Operations. The following AJ measures should be employed when the radar set is under countermeasure attack in the search mode:

(1) *Against jamming.*

(*a*) Select a narrower sector to scan.

(*b*) Adjust the RCVR GAIN control to minimize the effects of the jamming. Also establish, by use of this control, the direction from which the jamming is received.

(*c*) Operate the radar set manually (AUTO-MAN selector switch in MAN TRACK VIDEO position) and, by observing where the jamming signal is strongest, locate the probable azimuth and elevation of the jamming source. Then return to search operation and try to locate targets on the edges of the jammed area as well as within the jammed area.

(*d*) As soon as practicable (but not while the countermeasure attack is in progress), select a different radar site, preferably one which will afford a screening crest between the radar and the source of the jamming.

(*e*) Keep the radar set on the air. No matter how severe the jamming, there is always a chance of locating targets during breaks in the jamming pattern.

(2) *Against deception.*

(*a*) Observe carefully both the visual and aural indications of all targets. The regular strength and uniform spacing of the deception signals on the scope and the aural indications which differ from those of known types of targets will help to identify the false targets.

(*b*) Observe the indications of target movement. Familiarity with the motion of all types of real targets should assist the operator in distinguishing between real and false targets.

b. Tracking Mode Antijamming Operation. The following antijamming procedures should be employed when the radar set is under a countermeasure attack in the tracking mode:

(1) *Against jamming.*

(*a*) Operate the radar set manually (AUTO-MAN selector switch in the MAN TRACK AUDIO position), and adjust the AZIMUTH and ELEVATION handwheels to maintain maximum amplitude of the audio display. A gentle rocking of these controls should help the operator to see the target through the jamming.

(*b*) Adjust the RANGE handwheel for maximum audio amplitude on the scope display.

(*c*) If the target becomes lost in the jamming, adjust the AZIMUTH, ELEVATION, and RANGE handwheels to continue tracking at the same rate and in the same direction in which the target was moving before the interference. This may permit acquisition of the target when it moves out of the jamming cover.

(*e*) Continue to track and *do not* turn off the radar. A shutdown will inform the jammer crew that they are being effective.

(*f*) When practicable, site the radar so that a screening crest will protect the radar from jamming that may originate in areas that are not of primary interest.

(2) *Against deception.*

(*a*) Observe the appearance of target indications carefully. A transmission deception signal will maintain a constant strength, while real target indications tend to vary in strength with the movement of the target.

(*b*) In most cases, real target movement will be definite and purposeful where the indications of reflection deception devices probably will remain stationary or evidence erratic or random changes in range and azimuth.

45. Reporting and Recording

The existence of unidentifiable interfering signals should be reported immediately. This report enables higher headquarters, through correlation of information from other units operating on various frequencies within a particular portion of the frequency spectrum, to determine whether countermeasures actually are being encountered. Prompt, accurate, and complete reporting of countermeasure information can give warning of impending enemy action in a sector or on a broad front and may provide intelligence on the extent and importance of such action.

a. Initial Report. When countermeasure signals are encountered, they must be reported immediately to higher echelon through the radar operator's immediate supervisor. Attempted as well as successful, countermeasure activity should be reported. The operator must determine and report as quickly as possible the following information:

(1) The frequency being affected and the width of the frequency coverage of the countermeasure signal, if it can be established.

(2) The type of countermeasure signal (transmission or reflection, jamming or deception) and the type of modulation, if any, when the signal is jamming.

(3) The time and duration of the interference, including repetition, if any.

(4) The signal strength and its effect on radar operation, including the effect on other radar sets in the area if they can be contacted.

(5) As accurately as possible, the azimuth and elevation to the origin of the countermeasure signal.

(6) Unit, name, and grade of the operator making the report.

Note. The items in (1) through (6) above are suggested. Local standing operating procedures should designate the items to be included in the report and their order of priority.

b. Detailed Report. Immediately after the countermeasure attack occurs, a detailed report of the reception of countermeasures will be submitted to the commanding officer by the person in charge of the radar station. The commanding officer will have the report processed through channels as required by the tactical situation.

c. Recording. When operating under a countermeasure attack, the radar operator should keep a running record of events. The material for the record may be in the form of notes made by the operator, or it may be a verbal account given by the operator to another crewmember who, in turn, will make notes for the recorder. The events to be recorded are the time of the initial reception of the interfer-

ence; the visual and aural indications of the countermeasure signals; the means or operations used to determine the type, strength, direction of origin, and effectiveness of the countermeasure signals; the progressive steps taken to combat the countermeasures; and the results and effectiveness of each AJ measure as it is applied. This information may be required for detailed reports and will be valuable for future use by both operational and higher echelon personnel.

CHAPTER 8

DECONTAMINATION OF EQUIPMENT

46. General

a. This chapter touches only briefly on the subject of decontamination of equipment. In order to understand precisely how to accomplish these operations the radar section should become thoroughly familiar with the procedures outlined in TM 3–200, TM 3–225, and FM 21–40.

b. Equipment which has been contaminated by chemical, biological, or radiological agents must be decontaminated in order to reduce the hazard to personnel. Decontamination can be done by covering, removing, destroying or changing into harmless substances the contaminating material. Personnel performing CBR decontamination should wear the mask, and normal clothing buttoned at the neck and tied at the wrists and ankles with string (trousers bloused). For added protection, personnel may wear any other protective items that are available.

47. Chemical Decontamination

The best method for decontamination of radar equipment is by use of hot air; the next best method is by aeration or weathering. The metal parts exposed to blister and V-agents may be decontaminated with DS2 which is an excellent decontaminant for this equipment; it is also available to the radar section. Electrical devices which contain electron tubes or other heat-producing units normally are decontaminated by the heat given off during operation.

48. Biological Decontamination

A decontaminant for destroying or removing contamination should be effective against a variety of biological agents. Items currently available are natural decontaminants and chemical decontaminants. Most decontaminants and procedures for decontamination are effective for biological decontamination. Natural decontamination by rain, wind, and sunlight will destroy most biological agents on exterior of equipment within a day. Ethylene oxide or carbonide may be used to decontaminate the interior of equipment.

49. Radiological Decontamination

Decontaminants which have good cleansing characteristics normally are used for radiological decontamination because the contaminants for fallout usually are finely divided particles which adhere closely to materials and tend to settle into pores and crevices. In most military situations, radiological contaminants are satisfactorily removed by flushing with water, by the use of steam, and by brushing. The use of DS2 procedures for chemical decontamination of equipment also will remove most radiological contamination. When speed is not an important factor, aging becomes the most desirable method since it will make laborious decontamination work unnecessary.

CHAPTER 9

TRAINING

50. Purpose and Scope

The purpose of this chapter is to present the requirements for training the personnel of a radar section in the performance of their duties. It includes general information on the conduct of training.

51. Objectives

The objectives are to train radar crewmen rapidly in their individual duties and, through drill, to weld them into an effective, coordinated team able to function effectively in combat. Optimum efficiency is attained through frequent drills.

52. Conduct of Training

a. Training will be conducted in accordance with the principles set forth in FM 21–5. The goal of training should be the standards set forth in AR 611–201, ATP 6–100, and Army Subject Schedule 6–10.

b. Individual training is conducted by noncommissioned officers as far as practicable. Officers are responsible for preparing training plans, for conducting unit training, and for supervising and testing individual training.

c. Throughout training, the application of prior instruction to current training must be emphasized.

d. An informal record of the training received by each individual in the section is maintained by chief of section. This record should show each period of instruction attended, tests taken, and remarks pertinent to determine the training status of the individual. Collectively, these individual training records serve as a ready reference to determine the radar section's status of training. *Requiring the chief of section to keep these records emphasizes the training responsibility that he personally shares with the radar officer toward his section.*

e. The necessity for developing leadership and initiative in noncommissioned officers must be emphasized constantly throughout training.

53. Standards to be Attained

Each member of a radar section must know the duties of the other members of the section. Section personnel must be able to perform efficiently in all positions. This goal is attained by rotation of duties during training.

54. Training in Electronic Counter-Countermeasures

Radar trainer AN/ULT–T2 is a transportable, low-power radar transmitter primarily designed for use with any X-band radar set for training radar operators in antijamming techniques. The selected jamming signal is displayed on the scope of the radar, as well as through the loudspeaker and/or earphones, simultaneously with the target signal. Instructions for installation and operation of the radar trainer AN/ULT–T2 are contained in TM 11–6940–205–15.

CHAPTER 10

DESTRUCTION OF EQUIPMENT

55. General

a. Tactical situations may arise in which it is necessary to abandon equipment in the combat zone. In such a situation, all abandoned equipment must be destroyed to prevent its use by the enemy.

b. The destruction of equipment subject to capture or abandonment in the combat zone will be undertaken only upon authority delegated by a division or higher commander.

56. Principles

All sections will prepare plans for destroying their equipment in order to reduce the time required should destruction become necessary. The principles to apply are as follows:

a. Plans for destruction of equipment must be adequate, uniform, and easily carried out in the field.

b. Destruction must be as complete as the available time, equipment, and personnel will permit. Since complete destruction requires considerable time, priorities must be established so that the more essential parts are destroyed first.

c. The same essential parts must be destroyed on all like units to prevent the enemy from constructing a complete unit from damaged ones.

d. Spare parts and accessories must be given the same priorities as the parts installed on the equipment.

57. Methods

To destroy equipment adequately and uniformly, all personnel of the unit must know the plan and priority of destruction. For detailed information on the destruction of the radar set AN/TPS–25A, see TM 11–5840–217–10; on the destruction of the power unit see appropriate TM; and on the destruction of the vehicles, see the applicable vehicle manuals.

CHAPTER 11

QUALIFICATION TESTS FOR AN/TPS–25A RADAR SPECIALISTS

58. Purpose and Scope

This chapter describes the tests to be given in the qualification of AN/TPS–25A radar specialists. Tests based upon these outlines are designed to measure a radar crewman's skill in the emplacement and operation of the radar set AN/TPS–25. Tests based upon these outlines are designed to determine the relative proficiency of an individual crewman in his performance of duties as a radar specialist and are not intended for use in determining the relative proficiency of radar sections or higher units. These tests also are designed to serve as an incentive for the individual radar crewmen to expand their knowledge to cover all duties in the radar section, thereby increasing their value to the unit.

59. Preparation of Tests

The tests will be prepared under the direction of the division artillery commander or battalion commander in the separate brigade and should consider the following:

a. Tests should be standardized so that the difference between test scores of any two individuals will be a valid measurement of differences in their skills.

b. Each radar crewman is a prospective candidate and the tests should be available upon his request.

60. Test Organization

The qualification tests are organized to follow a logical sequence of events. They include the nomenclature of the radar set AN/TPS–25, selection of site, emplacement of the radar, checking the settings of the operational controls, performance of operational checks, orientation of the antenna, orientation and calibration of the X and Y counters, map reading and use of plotting equipment, battlefield surveillance, and moving ground target location. The tests should be conducted in the sequence in which they are presented in the text.

61. Administration of Tests

a. Because of differences in equipment, some modification may be necessary in the administration of these tests to some units. Modification in the tests should be accompanied by a reevaluation of the weighting system.

b. The target acquisition platoon leader is responsible for the testing of personnel within his platoon. Generally, the tests will be administered as follows:

(1) An officer, warrant officer, or enlisted man who is fully qualified and experienced in the subject covered by the test will be detailed as the examiner to administer the test.

(2) Each section of the qualification tests may be administered over a period of time that will be standardized throughout the unit.

(3) A single test, when started, will be conducted from start to finish without interruption.

(4) Assistance will be furnished to the candidate as prescribed in each test, however, the candidate will receive no unauthorized assistance. If a candidate fails any test because of the examiner or any assistant, the test will be disregarded and the candidate will be given another test of the same nature.

(5) Times are not prescribed for each test because of the differing requirements in units and the varying effects of weather on the tests. However, the examiner should make appropriate cuts when excessive time is taken to complete a portion of a test. The responsible officer must decide what constitutes excessive

time prior to the administration of the tests, and according to the conditions existing at that time.

(6) The examiner will explain to the candidate the scope of the test and indicate the men who will act as his assistants. The examiner will critique the candidate's performance at the completion of the test and turn the tentative score in to the platoon leader. The platoon leader will compute the final score and forward the test score to the division artillery or battalion headquarters.

62. Qualification Scores

A total maximum score of 100 is possible upon completion of the tests. The point spreadout to determine expert, first class specialist, and second class specialist is as follows:

Individual Classification	*Points*
Expert	90–100
First class specialist	80–89
Second class specialist	70–79

63. Outline of Tests

Para	Subject	Number of tests	Points each	Maximum credit
64	Nomenclature of radar set AN/TPS–25A	1	5	5
65	Selection of site and emplacement	1	8	8
66	Operation of radar set AN/TPS–25A	6	--	68
	Test 1	(1)	12	(12)
	Tests 2 and 3	(2)	14	(28)
	Test 4	(1)	18	(18)
	Tests 5 and 6	(2)	5	(10)
67	Map reading and use of plotting equipment	1	6	6
68	Battlefield surveillance and moving target location	1	13	13
	Total	10	--	100

64. Nomenclature of Radar Set AN/TPS–25A

a. Scope of Test. One test will be conducted that will require the candidate to locate, name, and/or state the purpose of various parts of the radar set AN/TPS–25A.

b. Special Instructions. The nomenclature printed on the parts on which the candidate is to be questioned will be covered with masking tape or similar material.

c. Outline of Test.

Examiner commands—	Action of candidate
LOCATE, NAME, AND/OR STATE THE PURPOSE OF THE PARTS NAMED. (The examiner will select 20 of the parts listed in TM 11–5840–217–10, fig. 2 through 16.)	Locates, names, and/or states the purpose of the designated parts.

d. Penalties.

(1) Cut 0.25 points for each error in nomenclature or statement of purpose and for each failure to locate the specified part.

(2) If the total penalties exceed 3 points, no credit will be awarded.

e. Credit. Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 63.

65. Selection of Site and Emplacement

a. Scope of Test. One test will be conducted in which the candidate will be required to select a radar site and explain how he would emplace the set.

b. Special Instructions.

(1) The examiner will prepare for the candidate's use a situation map of the area showing the following elements of an assumed situation.

(*a*) The location of established survey control in the area.

(*b*) The location of friendly units adja-

cent to the area in which the radar set will be sited.

(*c*) The general area designated for selecting a site.

(*d*) The suspected area of enemy activity.

(2) When assessing penalties, the examiner must bear in mind that any selected position is a compromise.

(3) The following equipment should be furnished:

(*a*) Aiming circle.

(*b*) Binoculars.

(*c*) Map of area with all pertinent information.

(*d*) Plotting equipment.

(4) A mission of battlefield surveillance to include the detection of both personnel and vehicles will be assigned to the candidate.

c. Outline of Test.

Examiner commands—	Action of candidate
SELECT A RADAR SITE AND EXPLAIN HOW YOU WOULD EMPLACE THE RADAR SET.	Selects a radar site within the designated area and explains how he would emplace the set.

d. Penalties.

(1) Cut a maximum of 2 points for failure to select a position which provides ready access, cover, and concealment.

(2) Cut a maximum of 1 point for failure to consider the proximity of survey control.

(3) Cut a maximum of 1 point for failure to consider the proximity of friendly units.

(4) Cut a maximum of 4 points for failure to locate the radar set within 4,500 meters of the area of interest.

(5) Cut a maximum of 2 points if the candidate selects an unsuitable location for the shelter and power unit.

(6) Cut a maximum of 4 points for improper explanation of emplacement.

(7) Cut the full 8 points if the candidate fails to obtain line of sight.

e. Credit. Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 63.

66. Operation of Radar Set AN/TPS–25A

a. Scope of Tests. Six tests will be conducted that will require the candidate to operate the radar set.

b. Special Instructions. Prior to the test, the examiner will have the radar set emplaced and the antenna leveled. He also will ascertain that the set is in good working order. After these duties have been performed and checks have been completed, the examiner will change all the operating controls so that the set will be out of adjustment.

c. Outline of Tests.

Test Number	Examiner commands—	Action of candidate
1	CHECK THE SETTINGS OF THE OPERATING CONTROLS AND RESET THE CONTROLS AS NECESSARY.	Makes the preliminary control settings as outlined in paragraph 13.
2	PLACE THIS SET IN OPERATION AND PERFORM OPERATIONAL CHECKS. (Examiner will check all the preliminary control settings and make the necessary corrections before allowing the candidate to start this test.)	Starts the set and performs the checks as prescribed in paragraphs 13 and 14.
3	ORIENT THE ANTENNA	Orients the antenna as prescribed in paragraphs 18 through 20.
4	ORIENT THE MAP ON THE PLOTTING BOARD.	Orients the map as prescribed in paragraphs 21 through 23.
5	ORIENT THE X AND Y COUNTERS TO INDICATE THE COORDINATES BY _____.	Orients the X and Y counters as prescribed in paragraph 25.

Test Number	Examiner commands—	Action of candidate
6	CALIBRATE THE X AND Y COUNTERS AND CHECK THE OPERATION OF THE PLOTTING COMPONENTS.	Calibrates the X and Y counter as prescribed in paragraph 26. Sets the ELEVATION counter to 0 and the RANGE COUNTER to 18,000 meters. Sets the AZIMUTH COUNTER to either 0 or 3,200 mils, whichever shows on the map on the plotting board. The Y counter should read 18,000 meters (± 140 meters) *more* than the radar coordinates if the azimuth set to 0 mils, 18,000 meters *less* than the radar coordinates if the azimuth was set to 3,200 mils. *a.* The X counter should read the radar coordinates (± 140 meters). Sets the AZIMUTH COUNTER to either 1,600 or 4,800 mils, whichever shows on the plotting board. The X counter should indicate 18,000 meters (± 140 meters) *more* than the radar coordinates if the azimuth was set to 1,600 mils or 18,000 meters *less* than the radar coordinates if the azimuth was set to 4,800 mils. The Y counter should read the radar coordinates (± 140 meters). *b.* After the X and Y counters have been calibrated, sets a problem into the radar and checks the operation of the plotting components. Sets the AZIMUTH COUNTER to either 800 or 4,000 mils. Checks the ELEVATION counter for a reading of 0 mils and sets the RANGE COUNTER to 14,140 meters. The readings on both the X and Y counters should be 10,000 meters (± 75 meters) *more* than the radar coordinates if the azimuth was set to 800 mils or 10,000 meters *less* than the radar coordinates if the azimuth was set to 4,000 mils. The ELEVATION COUNTER is set to + 143 mils, and the RANGE COUNTER is checked for a reading of 14,000 meters (± 75 meters).

d. Penalties.

(1) *Test 1.* Cut 3 points—

(*a*) For control on the radar set control omitted or improperly set.

(*b*) If the power supply switch is not set in OFF position.

(*c*) If the BOLTS Switch and the PHASES switch on the power unit are not set properly.

Note to examiner: Do not let the candidate proceed to test 2 if either switch is improperly set.

(*d*) For each air intake port and exhaust port that is not opened and for each switch on the shelter power distribution box not set to OFF.

(2) *Test 2.* Cut 3 points—

(*a*) If the candidate does not know that the RADIATE switch must be off during refueling operations at the power unit.

(*b*) If the power unit is not started properly and the line voltage is not adjusted properly.

(*c*) For each switch on the shelter power distribution box that is not set to its proper position.

(*d*) If the candidate does not check the readings at the receiver-transmitter after the transmitter has been turned on.

(*e*) If the candidate fails to adjust the scope for proper presentation and the VOLUME control and the RCVR GAIN control for noise output from the headphones or loudspeaker.

(3) *Test 3.*

(*a*) For failure to declutch the plotting board arm before searching in azimuth, cut 5 points.

(*b*) For failure to locate the orienting point, cut 10 points.

(*c*) For any procedural error in setting the known azimuth into the set, cut 5 points.

(4) *Test 4.* For failure to—

(*a*) Prepare the map properly, cut 4 points.

(*b*) Move the plotting board indicator light to the origin of the plotting board by using the MAP ZERO switch and the range coupling, cut 8 points.

(*c*) Set the MAP SCALE switch to the proper scale, cut 8 points.

(*d*) Properly aline the indicator light with the azimuth reference line, cut 4 points.

(*e*) Complete the orientation, cut 20 points.

(5) *Test 5.* Cut 5 points for—

(*a*) Any procedural error in orienting the X and Y counters.

(*b*) Failure to complete the orientation.

(6) *Test 6.* Cut 5 points for—

(*a*) Failure to complete the calibration.

(*b*) Failure to check the operation of the plotting components by using *both* of the test problems set forth in paragraph 25.

(7) *Cuts.* If the cuts for any one test exceed 50 percent of the total credit that can be awarded in the test, no credit will be awarded for that test.

e. Credit. Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 63.

67. Map Reading and Use of Plotting Equipment

a. Scope of Test. One test will be conducted in which the candidate will be required to set up a grid sheet and plot the known friendly and enemy positions.

b. Special Instructions.

(1) The following equipment will be made available to the candidate:

(*a*) One mapboard.

(*b*) One grid sheet.

(*c*) One aluminum range deflection protractor.

(*d*) One coordinate scale.

(*e*) One plotting scale.

(*f*) One protractor.

(*g*) One 4H and one 6H pencil.

(*h*) Red, blue, and green hard-lead pencils.

(*i*) Two map pins and two plotting needles.

(*j*) One contour map of the area.

(2) The examiner will provide the candidate with the known friendly and enemy positions. The candidate should be given the grid coordinates and the polar coordinates to plot. In at least one case, the height should be determined from a contour map. The radar azimuth indexes should be constructed.

c. Outline of Test.

Examiner commands—	Action of candidate
PLOT ALL KNOWN LOCATIONS ON GRID SHEET. (The locations and designations of adjacent units will be given to the candidate. Information may be in the form of polar coordinates or grid references. The candidate will have a map of the area for determining all additional information, such as heights of locations, labeling of lower left hand corner of grid sheet, etc.)	Constructs a grid sheet as prescribed in FM 6–40.

d. Penalties.

(1) Cut 0.6 point for the incorrect—

(*a*) Labeling of the grid sheet.

(*b*) Establishment of the indexes.

(*c*) Labeling of a known location.

(*d*) Use or reading of the range-deflection protractor.

(*e*) Use or reading of the coordinate scale.

(*f*) Use or reading of the plotting scale.

(*g*) Use of map pins or plotting needles.

(*h*) Use of 4H or 6H pencil.

(*i*) Use of colors.

(*j*) Use of height from the contour map.

(2) No credit will be allowed if penalties exceed 6 points.

e. Credit. Subject to the penalties assessed in

d above, credit will be awarded as indicated in paragraph 63.

68. Battlefield Surveillance and Moving Ground Target Locations

a. Scope of Test. One test will be conducted requiring the candidate to conduct battlefield surveillance and to detect and locate targets.

b. Special Instructions.

(1) The examiner will prepare for the candidate's use a situation map of the area showing the following elements of an assumed operation:

(*a*) The enemy and friendly frontlines.

(*b*) The road to be placed under surveillance by the radar section.

(2) An assistant will be made available to assist in operating the radar.

(3) The examiner will arrange for a vehicle to move up and down the target road at his command.

(4) The examiner will have the set emplaced and oriented at a suitable location for the test.

(5) Necessary communication to provide control of the vehicle will be provided by the examiner.

c. Outline of Test.

Examiner commands—	Action of candidate
SCAN THE AREA OF INTEREST FOR TARGETS AND DETERMINE THE LOCATION(S) OF THE TARGET(S) DETECTED.	Scans the specified area and determines the location(s) of target(s), as prescribed in paragraphs 28 through 31.

d. Penalties. For failure to—

(1) Properly aline the antenna on the center of the area of interest, cut 6 points.

(2) Use the AUTO SEARCH (mode 1) properly, cut 3 points.

(3) Determine the proper elevation angle for search of the assigned sector, cut 5 points.

(4) Use mode 4 (MAN TRACK AUDIO) to refine the location of the detected target, cut 4 points.

(5) Note the direction of movement of the target vehicle, cut 3 points.

(6) Detect the assigned target, a full cut will be assessed.

e. Credit. Subject to the penalties assessed in *d* above, credit will be awarded as indicated in paragraph 63.

APPENDIX

REFERENCES

1. Field Manuals (FM)

5–15	Field Fortifications.
5–20	Camouflage.
6–2	Artillery Survey.
6–10	Field Artillery Communications.
6–20–1	Field Artillery Tactics.
6–20–2	Field Artillery Techniques.
6–40	Field Artillery Cannon Gunnery.
6–121	Field Artillery Target Acquisition.
21–5	Military Training Management.
21–11	First Aid for Soldiers.
21–26	Map Reading.
21–30	Military Symbols.
21–40	Chemical, Biological and Nuclear Defense.
21–60	Visual Signals.

2. Technical Manuals (TM)

3–220	Chemical, Biological, and Radiological Decontamination.
5–2805–203–14	Organizational, DS and GS, Maintenance Manual: Engine, Gasoline: Military Standard Models (models 4A032–11) FSN 2805–776–0483 and (model 4A032–11) FSN 2805–068–7512.
5–2805–203–24P	Organizational, DS and GS, Maintenance Repair Parts and Special Tool Lists: Engine, Gasoline, Military Standard Models (model 4A032–1 FSN 2805–776–0483, (model 4A032–11) FSN 2805–068–7512.
5–6115–271–15	Organizational, DS, GS and Depot Maintenance Manual: Generator Set, Gasoline Engine, 3 KW (Less Engine) 3 KW, AC, 400 Cycle.
5–6115–271–25P	Organizational, DS, GS and Depot Maintenance Repair Parts and Special Tools: Generator Set, Gasoline Engine, 3KW (Less Engine), 3 KW AC, 400 Cycle.
(CM)11–750	Radar Electronic Counter-Countermeasures for the Operator (U).
11–5840–217–10	Operator's Manual: Radar Sets AN/TPS–25, AN/TPS–25A, and AN/TPS–25(XE–2).

11–5840–217–20	Organizational Maintenance Manual: Radar Sets AN/TPS–25, AN/TPS–25A, and AN/TPS–25(XE–2).
11–5840–217–ESC	Equipment Serviceability Criteria for Radar Sets AN/TPS–25, AN/TPS–25A, and AN/TPS–25(XE–2).
11–6940–205–15	Operator's Organizational, Field and Depot Maintenance: Trainer Radar AN/ULT–T2.
38–750	Army Equipment Record Procedure (CS_3 Test).

3. Army Regulations

611–201	Enlisted Military Occupational Specialties.
750–5	Organization, Policies, and Responsibilities for Maintenance Operations.

4. Miscellaneous

ASubjScd 6–10	Field Artillery Radar Operations.
ATP 6–100	Field Artillery Cannon Units.
TB 750–237	Identification and Handling of Radioactive Stems in the Army Supply System.
TOE 6–201	Headquarters and Headquarters Battery Airborne Division Artillery.
TOE 6–302	Headquarters and Headquarters Battery, Armored Division Artillery; or Headquarters and Headquarters Battery, Infantry Division Artillery; or Headquarters and Headquarters Battery, Infantry Division (Mechanized) Artillery.

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By Order of the Secretary of the Army:

W. C. WESTMORELAND,
General, United States Army,
Chief of Staff.

OFFICIAL:

KENNETH G. WICKHAM,
Major General, United States Army,
The Adjutant General.

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